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PIT AND QUARRY

AUGUST, 1938

ASTM Annual Meeting . . . Evolution of the Rotary Lime Kiln . . . Builds New Sand-Gravel Plant to Meet TVA Specifications . . . The Relative Water Capacities of Portland Cements

The Belt-Breaking MARBLE SAW —*and the* G.T.M.

FEW DRIVES ARE HARDER on belts than this big marble-cutting gang saw at the Missouri quarries of the Carthage Marble Corporation, world's largest producer of gray marble. Under the heavy shock load belt after belt quickly stretched and slipped, or broke. The saw was continually being shut down to repair or relace belts.

SEEKING A REMEDY the corporation called in the G.T.M.—Goodyear Technical Man. After noting the frequent overloading and the severe moisture condition due to water used in cutting, the G. T. M. specified a Goodyear COMPASS Belt made truly endless and it was applied on May 1, 1933.

AFTER 5 YEARS' SERVICE the Goodyear COMPASS is still running today. It has long outlasted any other belt on this saw, but far more important — *it has never once been off the drive — never required a single repair of any kind!* Slip is practically nil and the elimination of repairs has paid such big dividends that all gang saws in the quarry are now COMPASS-driven.

IN EVERY INDUSTRY similarly baffling problems are being economically solved by Goodyear rubber correctly applied by the G. T. M. The transmission of power and materials, elimination of vibration and protection of metals from corrosion are all his province. To bring him to your plant write Goodyear, Akron, Ohio, or Los Angeles, California — or the nearest Goodyear Mechanical Rubber Goods Distributor.

THE GREATEST NAME IN RUBBER

GOODYEAR

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AUG 3 1938

Experience Specifies

LINK-BELT POWER TRANSMISSION EQUIPMENT

● Link-Belt anti-friction and babbitted bearing transmission units and the complete line of Link-Belt positive drives—silent and roller chain drives, speed reducers, and variable speed transmissions—afford better ways of solving transmission problems. Among the results you get are lower power consumption—less lubrication needs—the elimination of much of that day-in-and-day-out maintenance—and greater dependability . . . . Send for general catalog No. 700.

THE SYMBOL OF QUALITY · LB · LINK-BELT

LINK-BELT COMPANY
2410 W. 18th St., Chicago
Indianapolis Philadelphia Atlanta
San Francisco Toronto
Offices in principal cities 7296

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"PUT THAT *Cleveland* ON THIS STUCK STEEL"

Time and again Cleveland drills are called upon to loosen up drill steels that otherwise would have to be shot out. Cleveland sinkers keep the cuttings cleared away from the bit and blown out of the hole, so that the drill steel is free to be withdrawn at all times. Clevelands are powerful in rotation, too, and that helps to keep steels from getting stuck.

Good hole blowing insures keeping cuttings away from the face, permitting the bit to operate always on virgin rock. That, and the strong rotation, promote rapid drilling, which means more footage for you. Let us send Bulletin 110 which gives the essential information on the whole Cleveland line.

• The Cleveland H11 is a winner in either hard or soft rock. It is fully described in Bulletin 118.

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THE CLEVELAND ROCK DRILL COMPANY

3734 EAST 78TH STREET • CLEVELAND, OHIO

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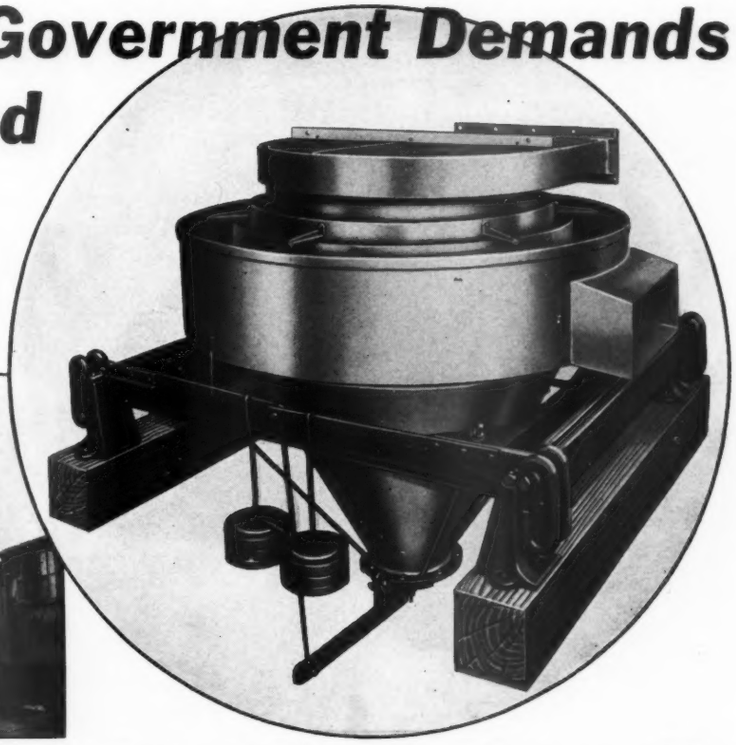
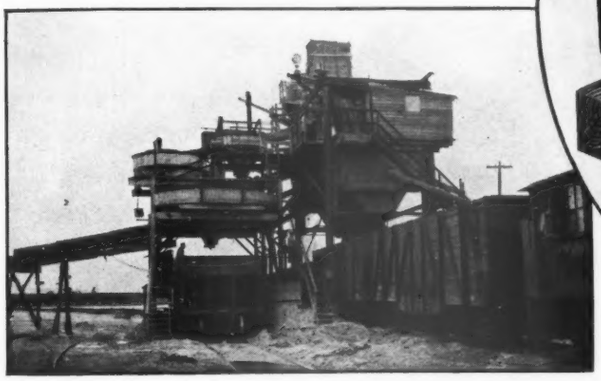
LEADERS IN DRILLING EQUIPMENT

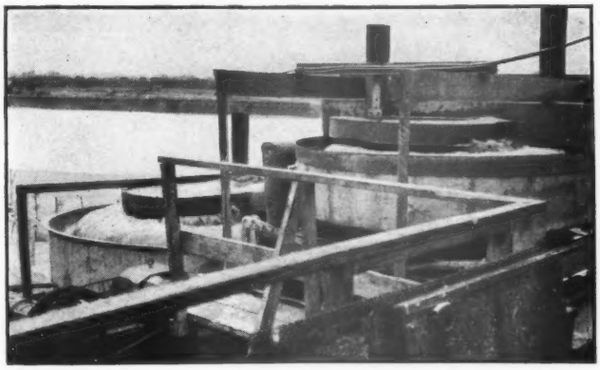
Meeting Rigid Government Demands For Graded Sand



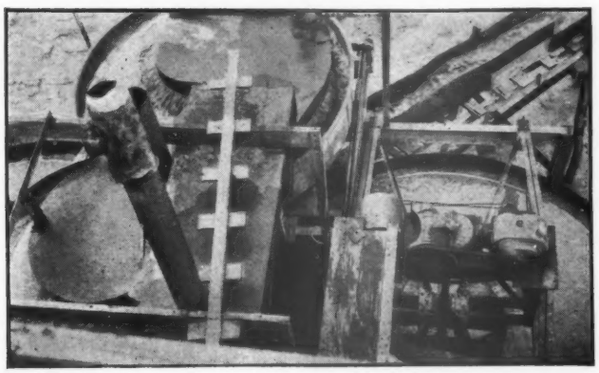
Plant of the Montgomery Gravel Company, Montgomery, Alabama, where four Nordberg-Wood Classifiers are installed.



Auto-Vortex Classifiers, six and eight feet in diameter.



At the right is one of the fifteen foot rake type bowl classifiers; at the left, two cone type machines.



Only this classifier could produce the quality of material required

Producing 100,000 tons of concrete sand for the Government lock and dam on the Warrior River at Tuscaloosa, Alabama, presented an unusually difficult problem of classification. To produce a sand that would meet the rigid specifications, the Montgomery Gravel Company built an entirely new plant in which was installed four Nordberg-Wood Classifiers. The choice of six and eight foot Auto-Vortex Cones and two fifteen foot diameter rake type bowl classifiers gave a most flexible arrangement and produced a sand which conformed with the various percentages required in the six sizings from four to one hundred mesh. These four classifiers delivered 800 tons of Federal specification sand and 265 tons of engine sand in ten hours with a motor load of only six connected horsepower.

NORDBERG MFG. CO.

MILWAUKEE, WIS.

CONE TYPE **AUTO-VORTEX CLASSIFIER** BOWL TYPE

KOEHRING
DUMPTOR

In the big rock cuts, on steep grades and large end-dump fills, Koehring Dumptors are moving and dumping rock and dirt at exceptionally low operating and maintenance costs. Hauling problems are solved with a profit when Dumptors are on the job. See this unit on the job and include it in your next dirt and rock hauling estimate.

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A MASON'S CEMENT
KOSMORTAR
EASY TO SPREAD

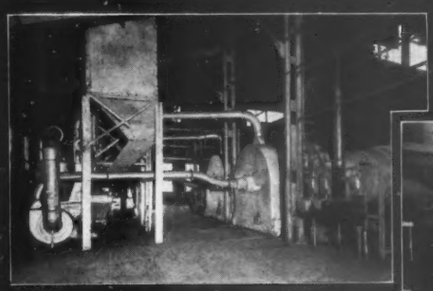
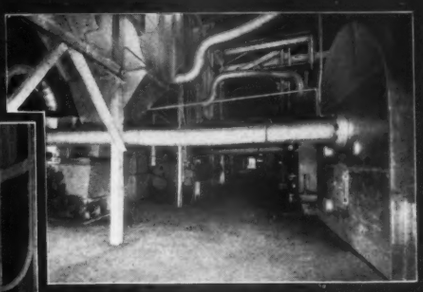
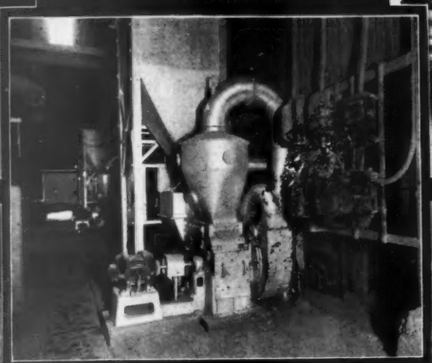
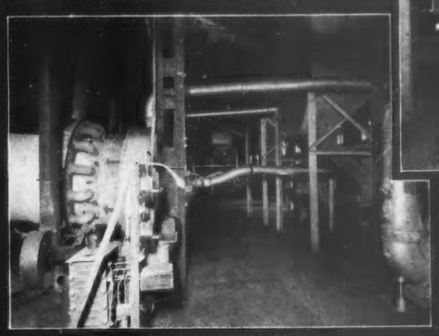
UNIPULVO
UNDERFED
UNIT-PULVERIZER

PORTLAND
KOSMOS
CEMENT

OUTSTANDINGLY SUCCESSFUL

Three High Grade Products now united as a result of the recent modernization program* in the KOSMOS Portland Cement Co. mill. After a trial of one unit-pulverizer for over six months, this well-known cement mill has now been completely equipped with

UNIPULVO UNIT PULVERIZERS

*See Story in
PIT & QUARRY
July 1938

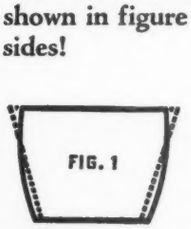
KOSMOS quality has always been high but now quality AND uniformity are more easily maintained, by use of UNIPULVOs

THE STRONG-SCOTT MFG. CO.
Minneapolis Minnesota

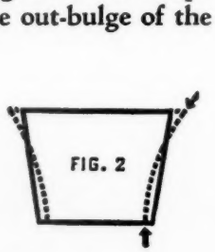
Feel THE Sidewalls of ANY V-BELT *AS IT BENDS*

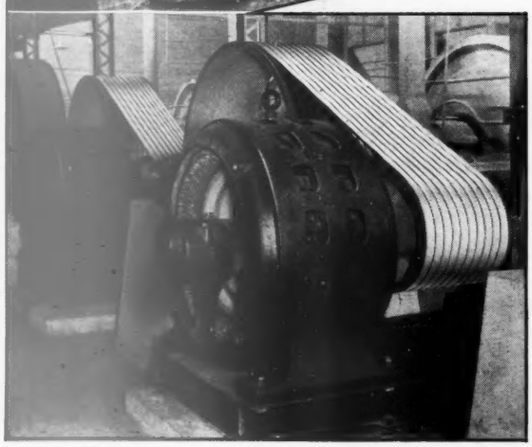
Prove for Yourself WHY the Concave Side SAVES MONEY

Feel the side-walls of *any* V-belt as it bends. You will feel its top narrow under tension, its bottom widen under compression. You will see that a *straight-sided* V-belt *must* assume in its sheave-groove the shape shown in figure 1, below. Note the out-bulge of the sides!



WHAT HAPPENS WHEN A V-BELT **BENDS**





Now try the same test with a Gates Vulco Rope. You will find that the *same shape change* merely *straightens* the precisely engineered concave side (see figure 2). There is no side-bulge. This insures uniform side-wall wear; *longer* life! Moreover, the full side-wall grip on the pulley naturally carries heavier loads without slipping—a saving in belts and also a saving in *power!*

The Gates Vulco Rope is the only V-Belt built with the patented concave side.

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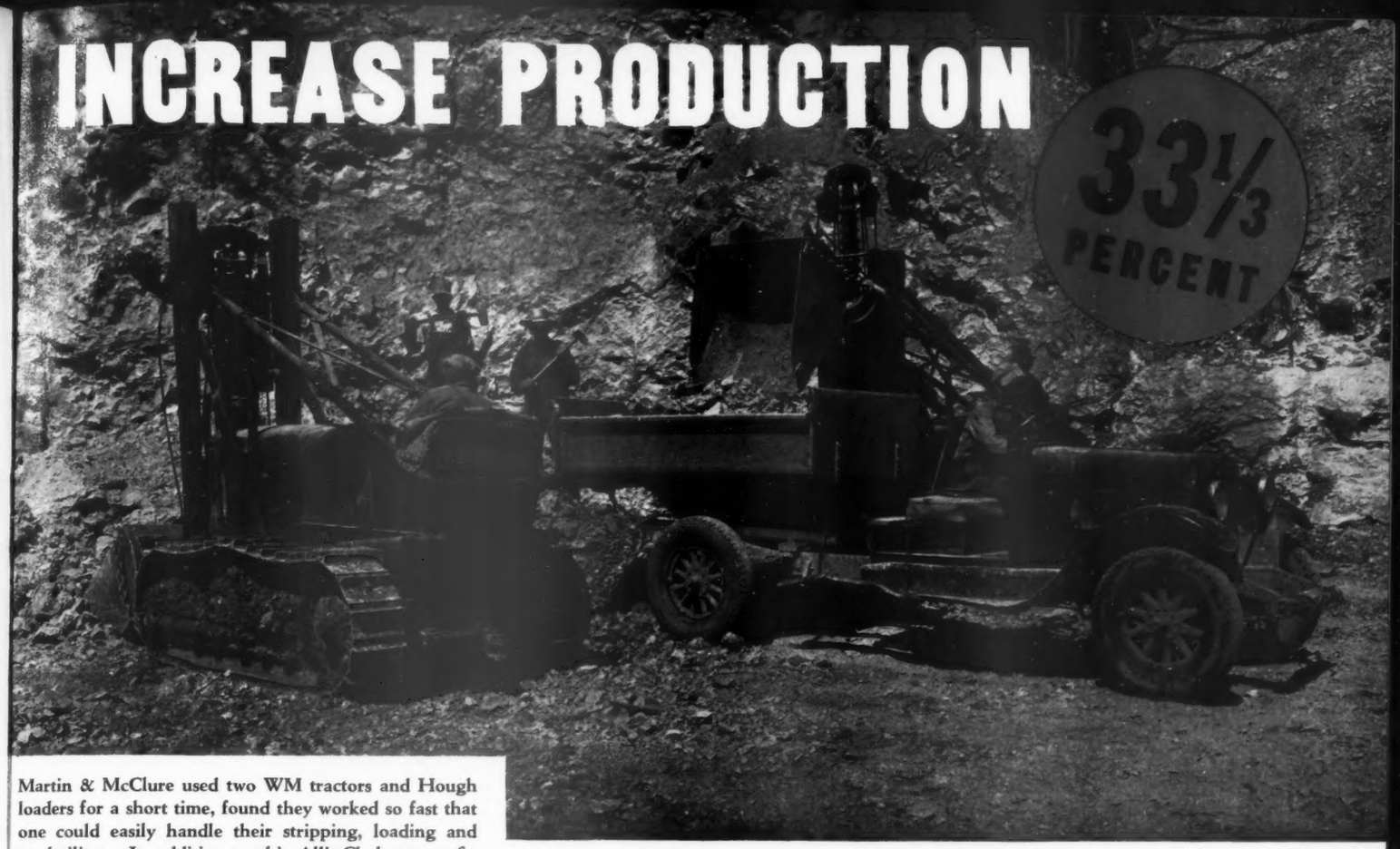
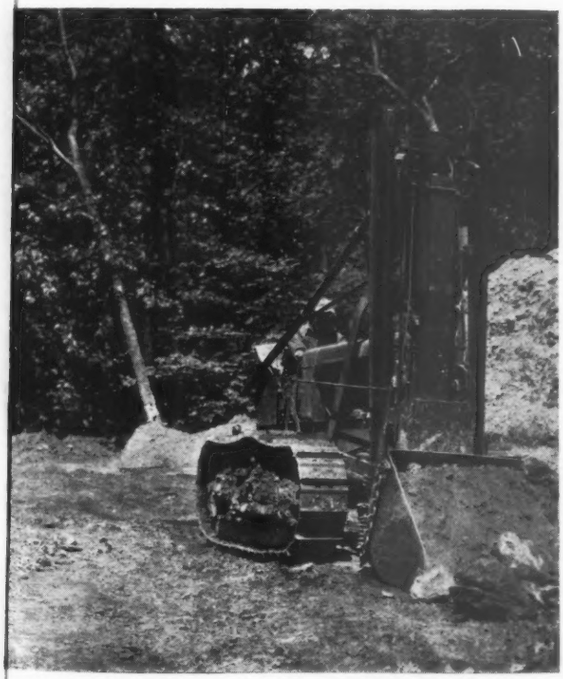
GATES VULCO ROPE DRIVES

INCREASE PRODUCTION



Martin & McClure used two WM tractors and Hough loaders for a short time, found they worked so fast that one could easily handle their stripping, loading and stockpiling. In addition to this Allis-Chalmers outfit, they use two A-C Power Units to drive a rock crusher and an A-C Pulverator.



WM and Hough loader stripping overburden. If desired a bulldozer blade can be substituted for the bucket. The change requires less than 10 minutes.

. . . CUT OPERATING COSTS WITH WM TRACTOR AND HOUGH LOADER

To cut stripping costs this spring Martin & McClure put an Allis-Chalmers WM tractor and Hough loader to work removing overburden from their limestone rock quarry near Colchester, Illinois. This outfit easily kept stripping operations far enough ahead so it also could be used for loading trucks in the pit and for handling lime and aggregate from stockpiles to trucks. Martin & McClure figure it increases their output 33⅓%, eliminates much backbreaking hand work and reduces labor costs nearly two-thirds. You can increase production and cut costs in the same way, by using the WM tractor and Hough loader. Bucket has full ½-yard capacity. Will dig and load into trucks at the rate of 30 to 40 yards an hour. Loads from stock pile at rate of 40 to 50 yards hourly. Drawbar is always free for pulling purposes. Unit can be easily and quickly towed from one pit to another on its own transport wheels.

Ask your Allis-Chalmers dealer how this fast-operating outfit can help you.

Gasoline and Controlled Ignition Oil Track-Type Tractors from 32 to 80 Drawbar H. P. . . . Tandem and Single Drive Speed Patrols . . . Drawn Blade Graders . . . Industrial Wheel Tractors . . . Stationary Power Units from 31 to 102 Brake H.P. . . . two, four and six-wheel scrapers, bulldozers, trailbuilders, loaders, winches and other allied equipment.

ALLIS-CHALMERS

TRACTOR DIVISION—MILWAUKEE, U. S. A.

CONFIDENCE

Here's why experienced operators the world over say "LET ALLIS-CHALMERS DO THE ENGINEERING!"

In Montana, a hundred miles from a rail head, cut off from all contact with the outside world six months of the year, is a large silver mine.

In the Philippines, half-way around the world from Allis-Chalmers, is a great cement mill.

Why is it that these operators thousands of miles away ... as well as hundreds within twelve hours flying time . . . depend on Allis-Chalmers equipment ... on Allis-Chalmers engineering?

It's because they have confidence in Allis-Chalmers!

Why did American Zinc Lead & Smelting Company specify Allis-Chalmers equipment in their Mascot plant?

Because they knew that Allis-Chalmers builds the equipment they need ... equipment they can depend on to do the job they want done!

But they got more than that ... and you'll get more ... when you install Allis-Chalmers machines! You get equipment that's engineered right . . . equipment backed by Allis-Chalmers engineering service, available whenever you want it!

And you get the benefits of the work of the Allis-Chalmers laboratories ... the testing and research continually in progress on which Allis-Chalmers' unbiased recommendations are based!

No wonder that thousands of other informed operators come to Allis-Chalmers, year after year. Engineering background, research, service ... get you the right equipment to do the job you want done. No other organization can give you all of this. That's why you can have confidence in Allis-Chalmers!

CRUSHING · CEMENT AND MINING DIVISION

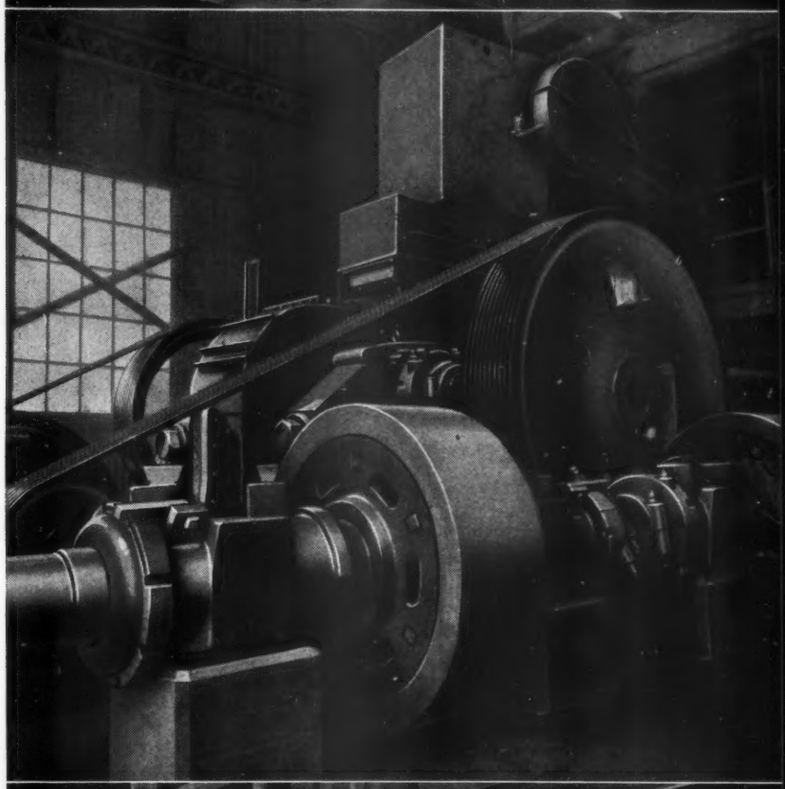
ALLIS-CHALMERS

MILWAUKEE · WISCONSIN

MINE RUN ORE at the Mascot Plant is crushed in this 30″ Allis-Chalmers Superior McCully Gyratory Crusher. Allis-Chalmers has no pet type of crusher. You'll get an unbiased recommendation of the proper crusher for your needs from the Allis-Chalmers types: **primary** gyratory, jaw, single and double roll; **secondary** gyratory, jaw, roll, and impact. And the right crusher will save you money.

ALLIS-CHALMERS CRUSHING ROLLS handle secondary crushing in the Mascot plant of American Zinc Lead & Smelting Co. These 54″ x 20″ Allis-Chalmers "Garfield" Type Crushing Rolls are driven through 100 hp Texrope Drives.

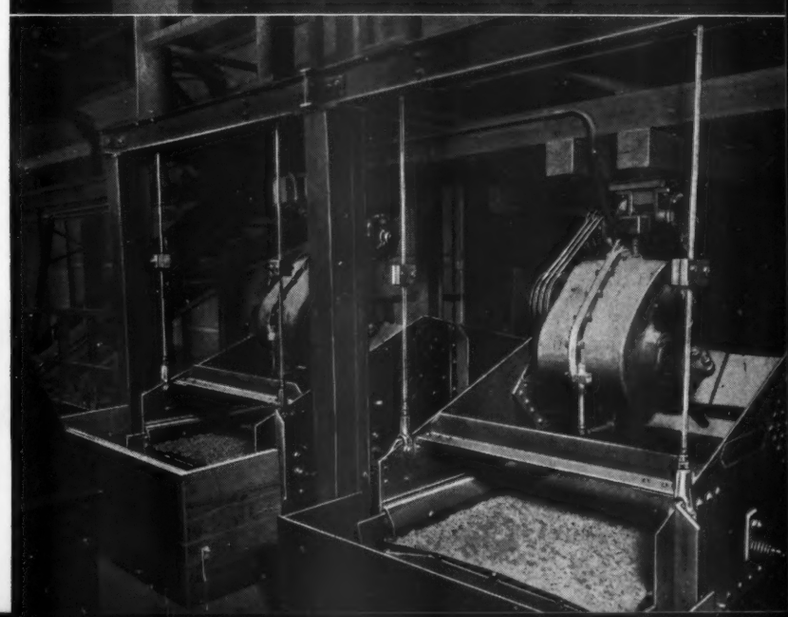
Allis-Chalmers Crushing Rolls are especially suitable for the production of ¼″ to 8 mesh material. They handle large tonnages at low cost, making a highly uniform product at less cents per ton than any other type of crusher. Allis-Chalmers builds "Anaconda," "Garfield," "Mesabi," and "XX" rolls. Diameters range from 24″ to 78″. A new 24″ x 16″ medium duty, low cost, crushing roll has been developed for economical production of sand.



THE AMERICAN ZINC LEAD & SMELTING CO. has twelve Allis-Chalmers Low-Head Vibrating screens in the Mascot plant. Among them are these two 4′ x 10′ Low-Head Screens, making ½″ separation (round holes), operating in closed circuit with 54″ x 20″ Allis-Chalmers "Garfield" Crushing Rolls. Total feed, including circulating load, is 300 T.P.H. of damp ore. Screens are driven by Allis-Chalmers Motors through Texrope Drives.

Allis-Chalmers builds four types of screen, with many sizes and variations of each for doing specific jobs. These include the "Aero-Vibe" inclined type for light and medium duty screening; "Centrifugal" inclined, positive-motion, eccentric type for maximum sizing and heavy duty work; "Low-Head" horizontal type for minimum space; and the "Utah" electro-magnetic type for fine screening. The "Utah" Electro-Magnetic Feeder handles material that must be fed at a highly uniform rate. All this equipment has been designed to save money on a particular job in your plant.

952



Allis-Chalmers also builds a complete line of equipment for Crushing, Screening, Washing . . . Concentration, Flotation, Cyanide, Treatment . . . Roasting, Smelting, Refining, and Converting Plants

Check the Items that Meet Your Wire Rope Requirements

1. A limber rope—one that is easy to handle [ ]
2. A rope that is quickly installed [ ]
3. A rope that is largely "broken in" before you put it to work [ ]
4. A rope that may be used with comparatively small sheaves [ ]
5. A rope that is highly resistant to fatigue and kinking [ ]
6. A rope that spools evenly and runs smoothly [ ]
7. A rope that is quickly, easily, perfectly spliced and socketed [ ]
8. A rope that can be handled with more than ordinary safety [ ]
9. A rope that lasts exceptionally long [ ]
10. A rope that saves you money [ ]

How many did you check? If more than five—*any five*—the chances are that "Flex-Set" Preformed Yellow Strand is your best buy.

Preforming shapes the strands during manufacture to the helical form they will maintain in the rope—with the amazing results listed above. The original "well-balanced" properties of Yellow Strand are *still there—plus* the advantages gained by preforming.

Items 2 and 3 above are *specially important* on equipment whose ropes are renewed more or less frequently. "Flex-Set" Preformed Yellow Strand costs less to install; can be speeded up under full load in less time; lasts longer. Try "Flex-Set" Preformed Yellow Strand on power shovels, for hoist line, crowd rope, rack rope; on dragline machines, for dragline and hoist line; on clamshell buckets, for holding line and closing line.

FREE **Riggers' Hand Book**
55 pages of just the information every rigger needs and wants. Write today for your copy. No charge. No obligation.

Broderick & Bascom Rope Co.
ST. LOUIS

Factories: St. Louis—Seattle—Peoria
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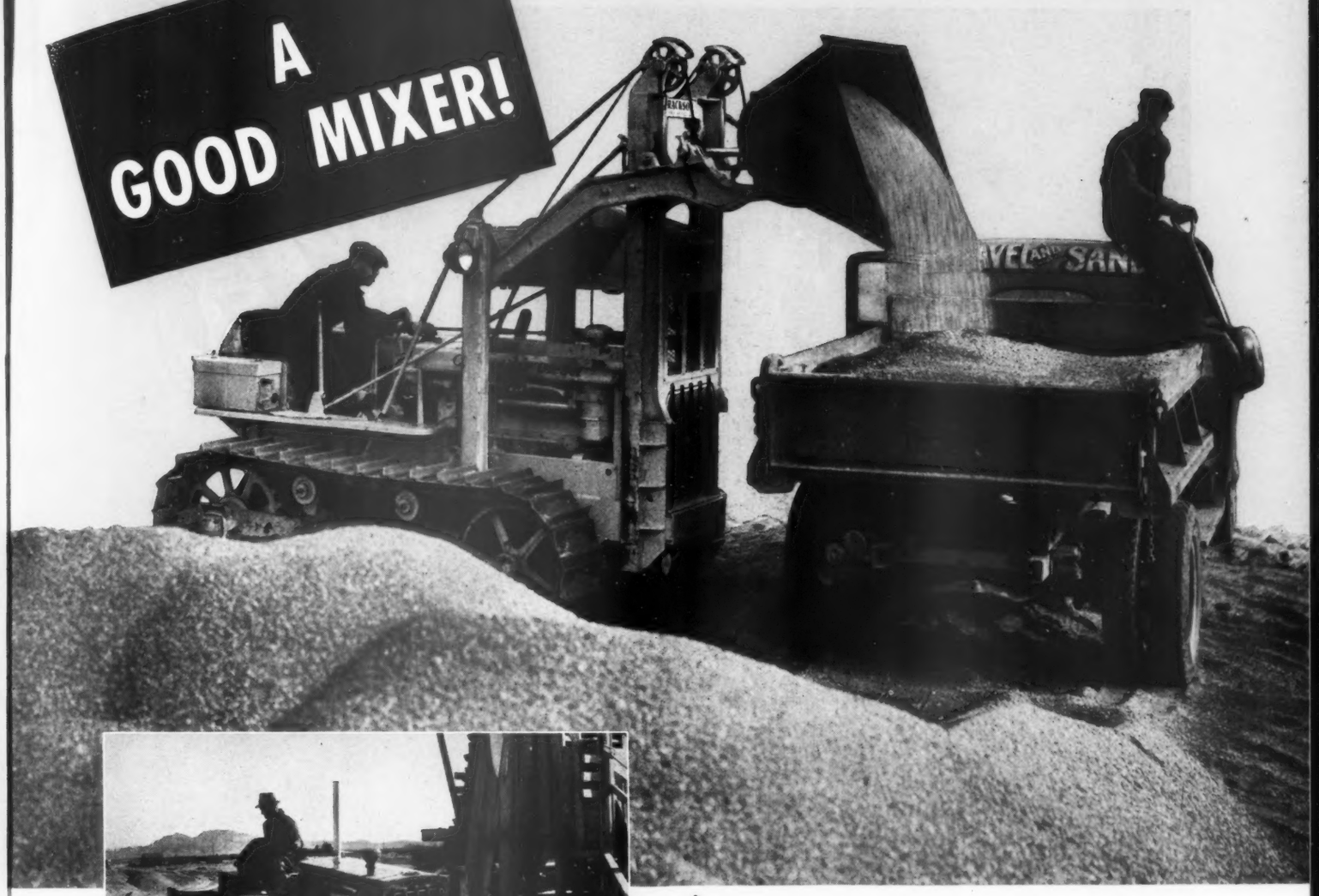
No. U-7R6

"Flex-Set" Preformed Yellow Strand

A GOOD MIXER!



"Caterpillar" Diesel D4 Tractor, with Trackson high shovel. Fast . . . efficient . . . and handily operated. Read the main text for more details.

Showing one of many jobs which a "Caterpillar" Diesel Tractor can perform around rock and gravel plants. This D4, pulling a scraper, is bringing gravel to the screen-hopper. Works 8 hours a day, on only 1 1/5 gallons of 6c fuel an hour! Sure-footed traction and ample power—for hauling heavy equipment, machinery and material!

Let's say you're in the gravel business . . . and, like Amidon Bros., of Pueblo, Colorado, receive an order for three different classes of gravel to be delivered *mixed.*

If, like Amidon Bros., you have a "Caterpillar" Diesel D4 Tractor, with a Trackson high shovel, you can fill the order—*conveniently, quickly* and *economically.* For your "Caterpillar" Diesel will readily shuttle back and forth between the truck and the three gravel piles—*mixing* them as it *loads* them; and handling 45 yards an hour!

In addition to the gravel-loading job, the tractor handles numerous other power-jobs around the plant! It uses the Trackson shovel to bulldoze and excavate. Also—like the other "Caterpillar" Diesel D4 Tractor shown here—its drawbar can be put to work at scraping, ripping and hauling!

With versatility like that . . . low fuel-consumption . . . and minimum maintenance, there's no wonder it takes *less* money to make money with "Caterpillar" Diesels!

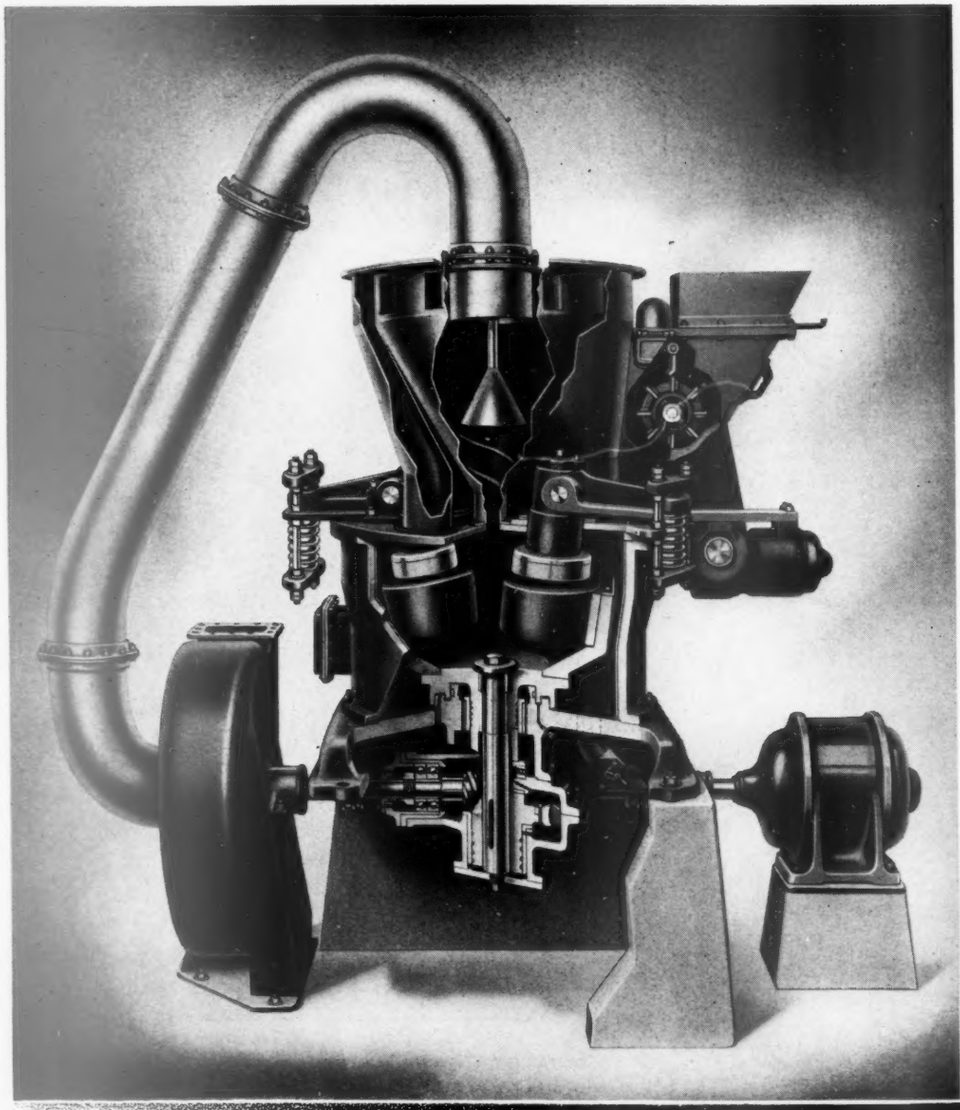
CATERPILLAR

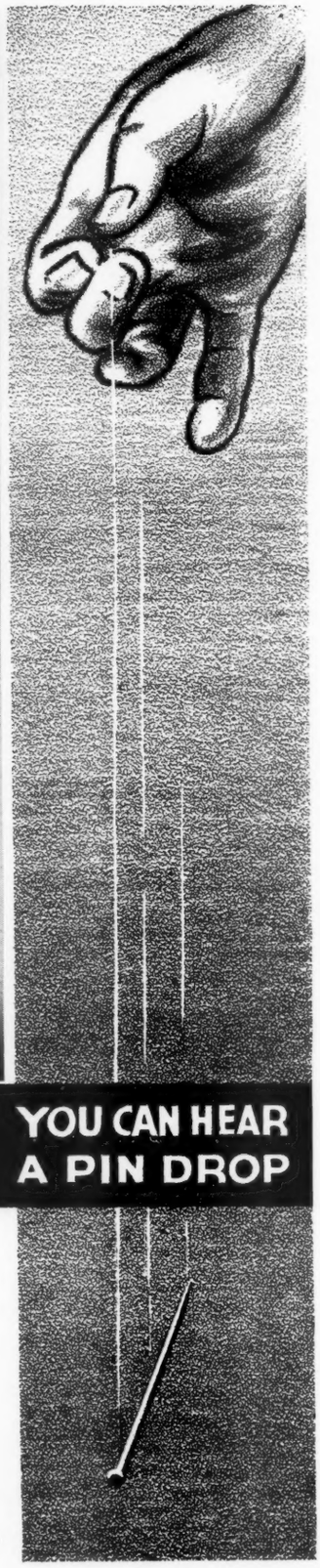
REG. U.S. PAT. OFF.

TRACTOR CO., PEORIA, ILL.

DIESEL ENGINES

TRACK-TYPE TRACTORS • ROAD MACHINERY





BOWL MILL

SO QUIET

YOU CAN HEAR A PIN DROP

SILENCE is eloquent . . . in a machine . . . for it signifies finely engineered construction.

In the quiet, smooth running BOWL MILL, there is no metal-to-metal contact in pulverizing.

That means vibrationless operation . . . reduced maintenance . . . and increased endurance.

Raymond BOWL MILLS run for months at a time . . . without shut-downs . . . grinding coal and direct-firing rotary kilns at lower costs than ever before obtained.

Only by seeing the BOWL MILL in action, can you appreciate its economy and smooth running qualities.

Write for Bulletin and list of installations

There are more than 200 BOWL MILLS now in operation in modern industrial plants throughout the country.

RAYMOND PULVERIZER DIVISION

COMBUSTION ENGINEERING COMPANY, INC.

1321 North Branch Street **CHICAGO**

Sales Offices in Principal Cities • • • In Canada: Combustion Engineering Corporation, Ltd., Montreal

DEMPSTER DUMPSTER

Simplicity
Efficiency
Durability
Economy

LOADING—Ready for pick-up

TRANSPORTING upon truck unit

DUMPING—One-man control

In the race for profits, the man who "beats the gun" always wins out against today's competition.

That's why the DEMPSTER-DUMPSTER gives you the "breaks" in material handling jobs. It enables you to get maximum yardage of hand loaded materials by saving time in loading, hauling and unloading.

Simply spot the DEMPSTER-DUMPSTER containers at loading points—and make pick-ups as fast as filled, using the automatic hoist. The trucks keep going continuously—no waste time, no idle men, no delays.

With DEMPSTER-DUMPSTER equipment available in sizes from one to six cubic yards capacity—easily mounted on any truck—you cannot afford to be without this modern time-saving, profit-producing method of handling bulk materials.

Bears the stamp of approval by the Quarry and Construction Industries as the result of years of severe service and unquestionable results. Write for details.

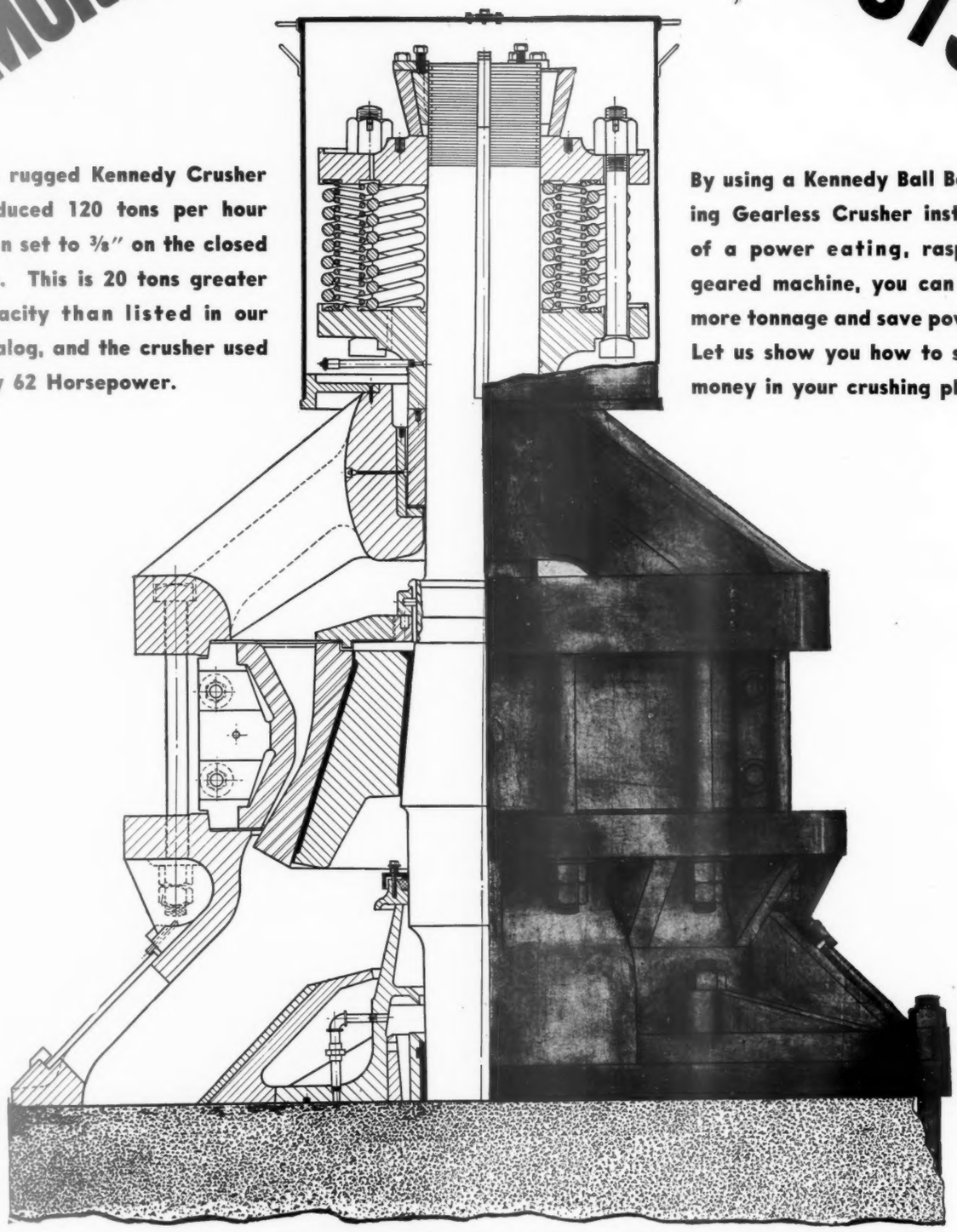
DEMPSTER BROTHERS, Inc. KNOXVILLE TENNESSEE

NEW YORK, N. Y. NASHVILLE, TENN. CHICAGO, ILL.

MORE TONNAGE–LOWER COSTS

This rugged Kennedy Crusher produced 120 tons per hour when set to 3/8" on the closed side. This is 20 tons greater capacity than listed in our catalog, and the crusher used only 62 Horsepower.

By using a Kennedy Ball Bearing Gearless Crusher instead of a power eating, rasping geared machine, you can get more tonnage and save power. Let us show you how to save money in your crushing plant.



WRITE FOR BULLETIN NO. 35

Sales agents in all principal American cities. . . . Wire us collect for the name of nearest agent. Also manufactured in Canada, Australia, France and England.

KENNEDY-VAN SAUN MFG. & ENG. CORP., 2 PARK AVE., NEW YORK, N. Y.

ADVANCED THINKING
KEEPS TIMKEN ROCK BITS AHEAD

Ever since the TIMKEN Rock Bit was introduced five years ago we have been constantly working to improve it.

Thus, as experience has pointed the way to greater efficiency and economy, important advancements have been made in the design of the TIMKEN Bit; in the special grade of TIMKEN Electric Furnace Steel from which the bits are made; and in the processes used to give them their characteristic deep hardening. All of these developments have had a far-reaching influence on the performance of TIMKEN Rock Bits. Drilling speed and accuracy have been increased steadily. Bit life has been greatly extended.

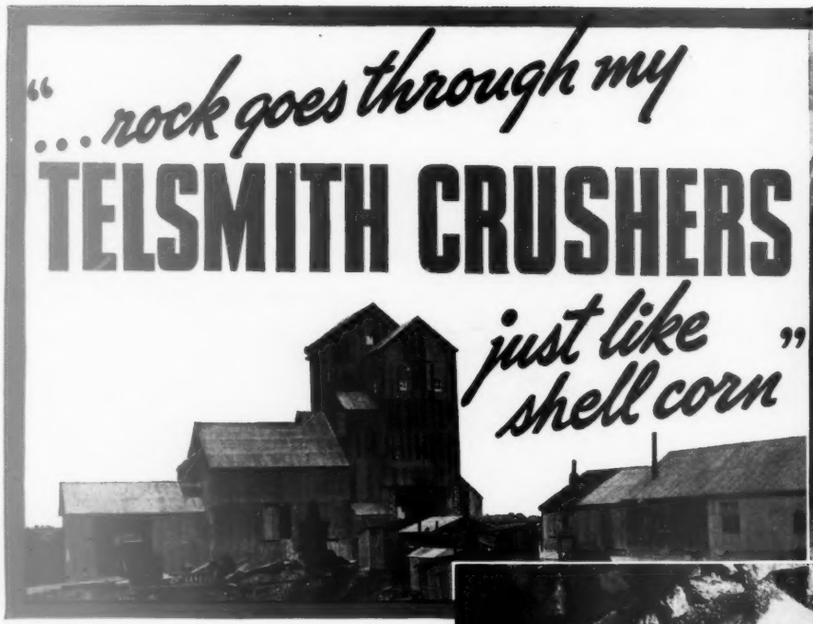
The TIMKEN Bits available now give rock bit users a tremendous advantage in drilling cost. Any new developments increasing their efficiency still further will be incorporated in their manufacture as fast as they are perfected.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

Manufacturers of TIMKEN Tapered Roller Bearings for automobiles, motor trucks, railroad cars and locomotives and all kinds of industrial machinery; TIMKEN Alloy Steels and Carbon and Alloy Seamless Tubing; TIMKEN Rock Bits; and TIMKEN Fuel Injection Equipment.

TIMKEN
ROCK BITS

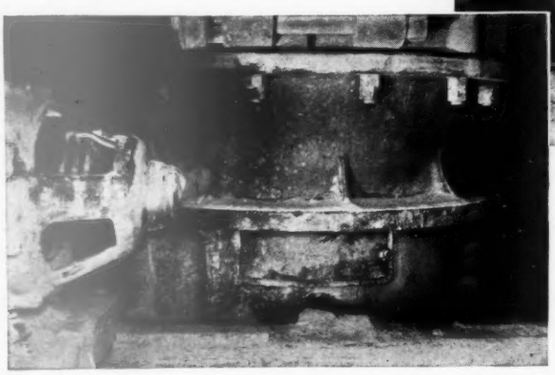
"...rock goes through my TELSMITH CRUSHERS just like shell corn"



Pontiac Stone Co. plant, near Pontiac, Ill., owned and operated by A. E. Markgraf in association with his son-in-law, Leo E. Lamb. Equipped with Telsmith Crushers, it crushes 140 — 150 tons of 97%-calcium limestone per hour.

A. E. Markgraf has operated crushers for over 25 years.

He says, "the Telsmith Breaker crushes from the time the rock gets into the concave. With other crushers it gets half-way down before they do any work to speak of."



The 16-B Telsmith Breaker (above) is set to crush to 3-in. size. After a stationary plate screen has removed part of the fines, aggregate goes to the No. 48 Telsmith Gyrasphere (right) for reduction to ¾-in. size.

"The rock goes through my Telsmith Crushers just like shell corn," says A. E. Markgraf. A quarry man for over twenty-five years, he knows his crushers. And he's had complete satisfaction with Telsmith Crushers ever since he bought his first one, some 18 years ago.

In 1936 he bought a high-speed No. 16-B Telsmith Primary Breaker for coarse crushing in his plant. His three trucks have been kept busy feeding it ever since . . . a 1000-ft. haul, 4 to 5 tons per truck-load . . . and as high as 26 loads in 17 minutes have been put through.

"Our demand for ¾-in. rock became so great that we replaced two reduction crushers of another make, powered with 50 and 35-hp. motors, with a Telsmith Gyrasphere which we powered with a 100-hp. motor, and practically doubled our capacity of small rock—yet we used less power with the Gyrasphere than with the other two," said Mr. Markgraf, "and we don't have so much slabby stuff." Why not find out for yourself why Telsmith crushing equipment turns out a better product at the lowest cost per ton. *Write for Bulletin Q-15.* QC-2

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THE ENSIGN-BICKFORD COMPANY
SIMSBURY, CONN.

CB75

CORDEAU·BICKFORD *Detonating Fuse*

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Preparation
Costs 30 to 50%
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BUCYRUS-ARMSTRONG 27-T blast-hole drills are a real money-saver on the job. In many quarries and open-pit mines, use of these modern drills has actually lowered preparation costs as much as 30 to 50%. There are many reasons for this—faster drilling per day, greater footage per year, larger diameter holes for better fragmentation, less labor, easier moves, minimum operating and maintenance costs, and dependable drill performance.
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GET DOWN TO "PAY DIRT" *faster and Cheaper with a* LORAIN

WHETHER that "pay dirt" is rock, coal, or what have you, you'll have it moving to the top faster if you leave the stripping to a Lorain. From the 3/8 to 2½-yd. Lorain line, it's easy to select a shovel or dragline of a range and capacity that will fit in profitably with your particular operations.

In addition to its standard line, Lorain also offers those two famous heavy-duty shovels, the "87" and "77", fitted with special long-range stripping booms which give them exceptional height and dumping radii for piling spoil banks well back from the cut. The "87" is equipped with a 30'6" boom, 27' stick, and 1¾-yd. dipper; the "77" has a 25' boom, 25' stick, and 1¼-yd. dipper.

Built to the proved principles of Center Drive design, Lorains have the power, speed, and strength which fits them for many duties besides stripping. Shovels can be used for loading service and draglines are quickly transformed into efficient clamshells for charging bins and loading cars.

Write today for catalogs and performance data.

The THEW SHOVEL Co.
LORAIN, OHIO

PRE-FORMED offers 1 COMMANDING ADVANTAGE

. . . a DOZEN lesser ones

Under Bending Stresses it Stands Up Longer- SAVES MONEY !

Though pre-formed rope offers many advantages—its growing success is due to the one commanding advantage that where bending stresses are severe, it has been able to lower contractors' rope costs. Being free from internal stresses, pre-formed rope is much slower to fatigue, in services where bending stresses are severe. Thus it stands up far longer and is the most economical rope to use over small sheaves and where reverse bends are unavoidable.

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10. End "porcupining." Wires when worn through, lie flat to rope.
11. Socket better, as wires can be mule-tailed in an orderly manner,—the foundation of safe socketing.
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Recommendations of our local distributor, or of our engineering staff, are promptly available. Write fully.

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UNION WIRE ROPES

The "ULTIMATE LOW COST WIRE ROPE"

PIT AND QUARRY

Vol. 31 August, 1938 No. 2

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The large illustration above shows how strip mines are eliminating track expense and cutting haulage costs with Sanford-Day's "Automatic" Drop-Bottom Trailers. Glance at the close-up illustration of a 15 Ton S-D Trailer. What could be more simple in construction—more fool-proof in operation? Doors are tripped automatically as trailer reaches the hopper or storage bin. Doors are closed automatically by the simple movement of the trailer as it leaves the hopper . . . no manual operation of any kind . . . no valves . . . no complicated devices or "gadgets" to worry with or maintain.

S-D Automatic Drop-Bottom Trailers are equally effective and efficient in cutting haulage and dumping costs in quarries of all types . . . in sand pits and many other classes of work where fast, uninterrupted hauling and dumping is required.

For over 35 years Sanford-Day have been recognized nationally as leaders in the building of mine and industrial cars. As pioneers in manufacturing automatic drop-bottom cars, many exclusive features have been developed. These exclusive features have been adapted to the S-D Automatic Drop-Bottom Trailer, giving it the same simplicity and operating economy that characterizes the S-D Automatic car. For simple, fast, fool-proof performance, investigate S-D Trailers before you buy.

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PIT AND QUARRY

CHICAGO AUGUST, 1938

Arthur S. Lane, 73, Dies in Connecticut

PROMINENT STONE PRODUCER

Arthur S. Lane

Arthur S. Lane, vice-president of John S. Lane & Son, Inc., Meriden, Conn., died July 17 at his home in Meriden. Mr. Lane was one of the best known of the country's crushed-stone producers and his death came as a shock to the members of the National Crushed Stone Assn., in the affairs of which he had long been prominent. He had served as a regional vice-president for nearly ten years.

Mr. Lane was born Oct. 27, 1864 and after completing his education entered railroad work. In 1891 he resigned to join his father, the late John S. Lane, in the operation of the present company which had been formed the year before and which is said to have been the first to operate a stone-crushing plant for commercial shipments by railway. He served as treasurer until a year or so ago when he became vice-president.

Funeral services were held at the Lane residence, 72 Colony St., Meriden, on Tuesday, July 19.

Condemn WPA Plan to Install Gravel Plant

County supervisors at Carmi, Ill., recently condemned the proposed installation of a gravel plant in White County by the Works Progress Administration to furnish material for public projects and highway construction because it would compete with privately-owned sand-and-gravel companies which have invested thousands of dollars in equipment in the county.

The W.P.A. proposal asks that White and Hamilton Counties pay $500 each to purchase gravel-digging equipment which would be operated by W.P.A. labor at W.P.A. wages. The plant would be located at Mink Island, near Maunie on the Illinois side of the Wabash River.

Appellate Court Sets NLRB Order Aside

The U. S. Circuit Court of Appeals at Asheville, N. C., has set aside an order of the National Labor Relations Board requiring the Standard Lime & Stone Co., Martinsburg, W. Va., to reinstate a group of strikers and to recognize the Quarry Workers' International Union as their bargaining agent.

The order was rooted in a strike which began April 24, 1935, and continued until June 13 of that year when the company announced the reopening of the plant. Violence occurred in connection with the opening, and resulted in the conviction and sentencing to prison of 16 men. The union complained to the board, which after a hearing issued the reinstatement order. The company appealed to the courts on the ground that the 16 men were no longer employees, and if they were not, the union did not represent a majority of the employees, and therefore, the company need not recognize it. Judge Morris A. Soper, Baltimore, Md., handed down the court's opinion.

Vermont Asbestos Firm Changes Operating Plan

Operation of the extensive asbestos-mining and milling properties at Eden, Vt., heretofore conducted by the Vermont Asbestos Corp., a wholly-owned subsidiary of the Ruberoid Co., will be carried on hereafter under the name of Vermont Asbestos Mines, division of The Ruberoid Co., it has been announced by Herbert Abraham, Ruberoid president.

Lightweight concrete building units are now being produced and marketed at Evansville, Ind., by the Concrete Supply Co.

California Silica Co. Improves Operations

DUST PROTECTION PROVIDED

The Silica Co. of California, Ltd., is making a number of improvements at its plant near Brentwood. It is installing three bunkers totalling 500 tons capacity at the mine, and one of 400 tons at the plant, together with all the necessary conveyor belts and bucket elevators.

At the deposit the old system of underground mining has been replaced by stripping of over-burden and recovering by blasting and the scraper system. A 25-ton load will be hauled by a semi trailer-truck, replacing three smaller units. The wet-screening department is being rebuilt and four new Straub circular screens are replacing three of an older type. A ball mill is being installed to reduce over-size to specifications. New Dorr classifiers are being erected in place of dewatering screws. The dry screening plant is being revamped, but no new equipment is being installed. Dust protection is being provided wherever necessary, this work being done under the supervision of state and insurance company engineers.

National Gypsum Co. to Expand Best Bros. Plant

Definite plans for the improvement and expansion of the Best Bros. Keene's Cement Co. plant at Medicine Lodge, Kan., are expected to be announced soon by the National Gypsum Co., which recently acquired the plant and mines located at Sun City.

M. H. Baker, president, visited the properties a few weeks ago while on an inspection tour.

The company is also planning to build a new $1,000,000 insulation-board plant at Savannah, Ga. Its new Mobile, Ala., plant, completed early this summer, has gone into production.

Concrete being placed as work was nearing completion on the new International Harvester Co. building at Indianapolis, Ind. The Carl Glesing Ready-Mix Concrete Co. supplied the material. The unit is a Lee transit mixer.

Pauls, Jessup, Advanced to Higher TVA Posts

Promotion of A. L. Pauls and George P. Jessup to higher positions in the TVA engineering staff has been announced.

Mr. Pauls, formerly project engineer on Pickwick Landing Dam, now substantially completed, has been appointed chief construction engineer with duties relating to all the TVA dam construction projects. He takes over duties formerly performed by T. B. Parker, recently made Chief Engineer.

Mr. Jessup, who has served as construction superintendent on both Wheeler and Guntersville dams, has been advanced to the position of project manager of the Authority's Gilbertsville Dam project, for which Congress recently appropriated funds to start construction. Both appointments are effective July 1, 1938.

Equip New Cement Mill in Turkey This Year

The Turkish Government is reported to have awarded a contract to a European equipment manufacturer for cement-mill machinery to be installed in a new plant at Sivas.

Installation of the machinery is expected to start in October of this year, and the plant should enter into operation in July, 1939, with a daily production capacity of 300 tons, or 90,000 tons per year.

Old York Valley Lime Plant Being Dismantled

The old York Valley lime plant near York, Pa., erected in 1903 and later used by the United States Gypsum Co., has been purchased and is being dismantled by the Lime & Hydrate Plants Co.

Part of the equipment will be removed to Dunkirk, Md., where the Patuxent Diatomaceous Refractories Co. will use part of the equipment in building a plant.

The equipment salvaged at the York Valley plant includes twelve kilns, 12 ft. in diameter and 50 ft. high, and were purchased for the sum of $12,000. The original investment was $150,000, according to Wm. J. Kuntz, head of the company which purchased the plant.

Resumes Production of Asphalt After Shutdown

Production of asphaltic rock has again been started by the Kentucky Rock Asphalt Co., at Kyrock, Ky., after a shutdown of seven months.

Approximately 300 men are being employed.

Seek Protection for Feldspar Industry

DOMESTIC SUPPLY ENDANGERED

North Carolina senators and representatives, including Senators Bailey and Reynolds, and Representatives Harry Bailey, A. L. Bulwinkle, C. R. Rogers and W. E. Hipps, recently jointly beseeched Secretary of State Hull to obtain adequate protection for the U. S. feldspar industry in the forthcoming reciprocal trade agreement with the United Kingdom.

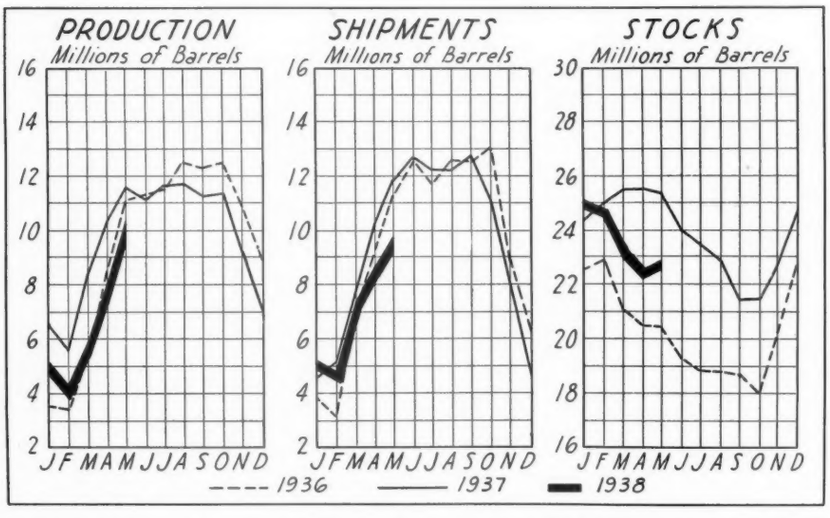
The delegation pointed out that the discovery in Canada of nepheline syenite, a substitute for feldspar which now enters this country duty-free, had seriously endangered the domestic feldspar industry, almost half of which is located in the Piedmont area of North Carolina.

Secretary Hull told the congressmen that every effort would be made to afford all possible protection to the industry.

Gypsum Workers Vote to Accept A. F. of L. Union

Employes of the Portsmouth, N. H., plant of the National Gypsum Co., recently voted to accept the American Federation of Labor for collective bargaining. The election was supervised by the National Labor Relations Board.

The Lehigh Portland Cement Co. is planning to establish a distributing plant on the waterfront at Oswego, N. Y., bringing in cargo over the state barge canal.



The Portland-cement industry in May, 1938, produced 10,361,000 bbl., shipped 9,752,000 bbl. from the mills, and had in stock at the end of the month 22,871,000 bbl., according to the Bureau of Mines. Production and shipments of Portland cement in May, 1938, showed decreases of 10.9 and 18.0 per cent., respectively, as compared with May, 1937. Stocks at mills were 10.3 per cent. lower than a year ago. The statistics were compiled from reports received by the Bureau of Mines from all manufacturing plants.

Output of Canadian Cement Is Increasing

PRICES STEADY SINCE 1931

Four firms, operating 12 mills, are producing cement in Canada. Their aggregate capital investment in the industry is estimated at $55,343,991. According to official reports, the amount of capital employed and the number of plants have increased. Cement production in 1937 is estimated at 6,139,851 bbl., or about 36 per cent. greater than for 1936, when it was 4,508,718 bbl.; and although still considerably below the 1929 peak of 12,284,081 bbl., the outlook for the cement industry is better now than at any time in the past eight years.

The use of this material in Canadian construction is gaining popularity. Increased use of concrete for highway surfacing has been marked, and the construction of concrete bridges and buildings has afforded an outlet of considerable importance.

According to information obtained by the U. S. Bureau of Mines from one of the leading cement producers in Canada, the price of cement f.o.b. a Montreal mill in the last year remained unchanged at $1.40 a bbl. (350 lb.), plus 15 c. for cement packed in paper sacks and 80 c. for that packed in cloth bags. Throughout Canada maximum and minimum prices f.o.b. works, have varied only slightly since 1931. The lowest prices have stayed at $1.25 per bbl. and the highest have ranged between $2.55 and $2.79 for the years between 1931 and 1936.

Cement exports in 1937 totaled 253,989 cwt. valued at $82,978, compared with 241,253 cwt. valued at $56,909 in 1936, an increase of more than 5 per cent. in volume and 44 per cent. in value. Leading destinations are Newfoundland, Trinidad and Tobago, other British West Indies, Peru, United Kingdom, and Bermuda. The United States takes a smaller quantity—8,707 cwt. valued at $7,235 in 1937.

Imports of Portland cement are not classified separately in the Canadian statistical returns but are combined with hydraulic cement, hydraulic lime, and expensive special-purpose cements which are not manufactured extensively in Canada. The total value of these cement imports in 1937 was $134,113, compared with $107,180 for 1936, an increase of more than 25 per cent. Of these imports, the United Kingdom furnishes the most—80,458 cwt. valued at $49,152 in 1937. The United States furnished 39,498 cwt. valued at $53,446, Belgium 16,823 cwt. at $9,533, Germany 2,187 cwt. at $1,306 and Italy, Japan and Netherlands very much smaller amounts.

Plant of the Cebu Portland Cement Co. at Naga, Philippine Islands.

Through their agents, the Earnshaw Docks and Honolulu Iron Works in Manila, P. I., the Allis-Chalmers Mfg. Co. has been awarded a contract for cement-making machinery for the Philippine government plant known as the Cebu Portland Cement Co., totaling $153,000.

On this contract the Allis-Chalmers company will furnish a 10 and 11-ft. by 175-ft. rotary kiln complete with motor. In connection with this kiln they will provide an air-quenching cooler 4½ ft. wide by 55 ft. long. In addition the contract includes a 7-ft. by 26-ft. raw-grinding compeb mill as well as a 7-ft. by 26-ft. clinker-grinding compeb mill. These mills will be directly driven by 500-h-p. motors which the Milwaukee concern will also supply.

All this equipment will be used in an addition to an existing cement plant for which the Allis-Chalmers Mfg. Co. supplied all the machinery in 1921. The plant operates under the wet process and the new equipment being supplied will increase the annual production by approximately 450,000 bbl.

Tennessee Firm Fetes Employees for Safety

The Standard Lime & Stone Co. plant at Asbury, Tenn., is proud of its record of two years without a lost-time accident among its 35 employes.

A "victory dinner" was given at Asbury High School recently celebrating the two-year safety record.

"We're proud of our two-year record," said L. A. Radeloff, plant superintendent, "but we're not going to quit with two years. We want to make it three or four years or more."

Among the company officials, who made safety talks at the dinner were Daniel B. Baker and David B. Baker, vice-presidents of Baltimore; F. C. Thomas, general superintendent, of Martinsburg, W. Va.; D. R. Voorhees, safety engineer, Martinsburg, and H. F. Moler, foreman of the plant.

New Gravel Plant to Open at Colorado, Tex.

Construction has been completed on the new Colorado, Tex., plant of the Hillsdale Gravel Co., Sweetwater, Tex., according to C. C. Johnston, superintendent, who supervised its erection. The new operation has a capacity of about 400 cu.yd. daily. Claude Storey is foreman and a force of ten men is to be employed in operating at the new location.

Earthen Products Spends $25,000 for Expansion

To utilize non-metallic mineral resources in the vicinity of Houston, Tex., the Earthen Products Co., of Houston, recently completed a $25,000 re-equipment and expansion program.

Management of the company, which processes filtering clays used largely in the oil industry, has been assumed by R. Earl McKaughan, son of the founder.

Opens Concrete-Block Plant at Columbus, Ind.

The Hawcreek Block Co., a new concern, has started the production of concrete-masonry units at Columbus, Ind. Aggregates are obtained from the plant of the Burnside Gravel Co.

Recent Equipment Installations ★ ★ ★

A new entrant in the ready-mixed-concrete field, the Independent Sand & Gravel Co. of Cincinnati, is using Lee transit mixers . . . *A Symons cone crusher was recently installed at the Richmond, Cal., plant of the Blake Bros. Co.* . . . A Simplicity triple-deck vibrating screen is a new piece of equipment at Central Michigan Gravel Co., Lansing, Mich.

The Diamond Springs (Cal.) Lime Co. has just placed a Roto-Clone dust-collecting system in service . . . *Donald Schenk, gravel operator at Durand, Mich., has ordered a ¾-cu. yd. Bay City shovel and a Simplicity vibrating screen for installation at his new plant* . . . New Allis-Chalmers double-deck screens were installed early this summer by the Perkins Gravel Co., Sacramento, Cal.

A Morris 6-in. sand pump went into operation in June at the Rochester, Mich., plant of the Henderson Sand & Gravel Co. . . . *Jackson & Church steam-curing kilns are now being used for the rapid curing of concrete units produced by the Michigan Pressed Brick Co., Detroit* . . . New Stearns strippers were recently installed in the concrete-products plants of W. H. Friedrich & Co., Coldwater, Mich., and Chris Abraham, Capac, Mich.

Building Up in June; Reverses Usual Trend

TOTAL IS HIGHEST FOR YEAR

Reversing the usual seasonal trend, building contracts awarded in the 37 eastern states during the month of June were larger in dollar volume than in any previous month of this year, according to F. W. Dodge Corp. The June total of $167,485,000 was 4 per cent. ahead of the May, 1938 figure, although 23 per cent. behind June of last year.

Residential-building contracts in June, amounting to $85,682,000, were also larger than for any previous month this year, being 3 per cent. ahead of May and only 8 per cent. behind June of last year. Since June, 1937, had the second largest residential contract volume of any month in 1937, the record of June, 1938, indicates continuous, though gradual, upward progress. Out of fifteen districts included in the Dodge corporation's entire territory, five showed residential building contract increases over June of last year, four showed decreases of less than 5 per cent., two had decreases between 5 and 10 per cent., and only four had decreases amounting to more than 10 per cent.

Non-residential building contracts, amounting to $81,803,000 in June, ran 5 per cent. ahead of May, but 35 per cent. behind June of last year.

Heavy engineering construction, of the public works and utilities classifications, which is expected to increase greatly in the coming months under the stimulus of the new Federal spending program, amounted to only $83,521,000 in June, being 32 per cent. less than the May figure and 16 per cent. under the figure for June of last year. The grand total of all building and engineering work recorded last month was $251,006,000, which was down 11 per cent. from the May figure and down 21 per cent. from June of last year.

The accumulated total of building and engineering contracts for the first half of this year is $1,294,272,000, being the highest for a similar period of any year since 1931, with the single exception of last year.

Marquette to Start Work on Vicksburg Terminal

Work is expected to start shortly on the new $250,000 terminal and distributing plant of the Marquette Cement Mfg. Co. at Vicksburg, Miss.

Builds New Sand Plant at Montoursville, Pa.

A new steel-and-concrete structure has been erected to replace the sand plant of J. A. Eck & Sons, Inc., Montoursville, Pa., destroyed by fire a short time ago.

New equipment replacing that ruined in the blaze has also been installed. The operation is located on the banks of the Susquehanna River.

Canada Abolishes Its Tax on Building Items

The elimination of Canada's 8-per cent. sales tax on 40 building trade items, including bricks, building tile, building blocks, cement, stone, plaster and lime, has been announced by Finance Minister Charles A. Dunning.

The move was widely acclaimed by builders throughout the Dominion as an aid to the industry.

The Reardon Cement & Insulation Co. of Cincinnati, O., is moving from its old location at 836 Reedy St. to a new building at 2837 Stanton Ave.

The same tools that strip overburden at the Crystal Silica Co., Los Angeles, Cal., are used to haul the sand to the washer. The tractor and scraper work 17 hours a day on 1.3 gal. of 6-c. fuel an hour. The company's product is used principally for sandblasting and as an ingredient in stucco.

First N. Y. Conviction Under Silicosis Code

FAIL TO USE DRILL VACUUMS

The first conviction for violation of the silicosis prevention rules of the New York Department of Labor was made on June 8 in the case of the Garafano Construction Co., Inc., which pleaded guilty to charges preferred by the Department before Magistrate Thomas A. Aurelio in Bronx Magistrate's Court. The rules violated were those relating to control of silica dust in rock drilling which became effective May 1, 1937. The Garafano firm is engaged in rock-drilling operations on the East 138th St. approach to the Triborough Bridge. On March 30 last, a Department of Labor inspector found the concern using two wagon drills without approved dust-removal equipment as required by the New York industrial code. On that date the Commissioner issued an order for the corporation to provide the required equipment. On April 14 inspectors found a two-drill Markley dust-control system on the job location but unconnected to the jack-hammers then operating. On four subsequent inspections the inspectors found dust-control equipment present but not connected to the drills.

A dust study conducted by the Division of Industrial Hygiene of the New York Labor Department disclosed an average dust concentration on the Garafano job of 24 million particles of dust per cu. ft. of air. The rock formation in which the drilling operation was being conducted was found to have more than 10 per cent. by weight of free silicon dioxide. In such rock formations a dust concentration in excess of 10 million particles per cu. ft. of air is held, under the New York rock-drilling code, to constitute an "injurious silica-dust concentration."

Prosecution was begun on May 25 when the defendant entered a plea of not guilty and secured an adjournment until June 1. Further adjournment was obtained until June 8 when Roy McCleskey, secretary of the Garafano company, pleaded guilty to the charge of failure to maintain and use equipment for the elimination of harmful silica dust. Magistrate Aurelio imposed a fine of $25.

Conklin & Son Take Over Wisconsin Plant

Facilities of the City Sand & Gravel Co., which operated a sand-and-gravel pit in the Madison, Wis., city limits, were recently taken over by Conklin & Sons Co., Madison.

National Crushed Stone Assn.
National Lime Assn.
National Slag Assn.
Portland Cement Assn.

WITH THE TRADE ASSOCIATIONS

National Sand & Gravel Assn.
National Industrial Sand Assn.
National Ready Mixed Concrete Assn.

AUGUST, 1938

PCA to Have Exhibit Building at N. Y. Fair

The Portland Cement Assn. is going ahead with plans for participation in the New York World's Fair of 1939.

Sketches for the proposed building which will house the association's exhibit are now in progress and work on the structure is expected to start in the fall.

WPA Lime Production Limited to Wisconsin

H. A. Huschke, manager of the agricultural department of the National Lime Assn., points out that the Relief Bill as signed by the President contained the following clause pertaining to the production of lime and marl with W.P.A. labor:

". . . projects for the production of lime and marl in Wisconsin for fertilizing soil for distribution to farmers under such conditions as may be determined by sponsors of such projects under provisions of State law; . . ."

"From this it will be noted that the many protests received by members of Congress from liming-material producers were effective to the extent that such projects will be legal only in Wisconsin. We regret that the entire provision was not stricken from the bill by the Conference Committee for the reason that this is a particularly vicious type of competition. The following facts and figures obtained from the Wisconsin W.P.A. will illustrate how these projects have operated in that State.

"In 1933 the Wisconsin legislature passed a law empowering county boards to sponsor the production of "agricultural lime" for distribution to farmers and specified that unemployed persons be used on such projects. These county boards hired or rented pulverizing or grinding equipment from owners at a rate of so much per ton of material processed. The labor was obtained in cities and villages and transported to and from the job each day. Farmers purchased the finished product at a cost which covered all items except labor.

"During a period of three to four years, 1,728,598 tons were produced. The average cost to the farmer was 62 c. per ton. The total average cost was $1.71 per ton, of which $1.17 per ton was paid for labor by W.P.A. The sponsor, or county board, was held responsible for the difference, or 54 c., which was actually paid by the farmer. We understand that the farmer was asked to pay slightly more than 54 c. to cover any costs that were not anticipated. This probably accounts for the 8 c. difference between 62 c. and 54 c. When a project was completed any surplus funds were prorated back to farmers who purchased the materials.

"In this manner farmers purchased liming materials at about ⅓ the actual cost of production, and the unemployed were given work. It is easy to understand why such projects are popular, and why much pressure would be applied to members of Congress for their continuance."

Success in Safety

Only 14 lost-time accidents were suffered by the cement industry in June, according to preliminary figures compiled by the Portland Cement Assn. following the annual June No-Accident Campaign. In 1937 there were 20, in 1936 the total was 34. Twenty-three were recorded in June, 1935, while in 1934 there were 18.

The experience of the P. C. A. indicates that determination plus correct thinking can eliminate industrial accidents and its results continue to set an example for the entire world of industry.

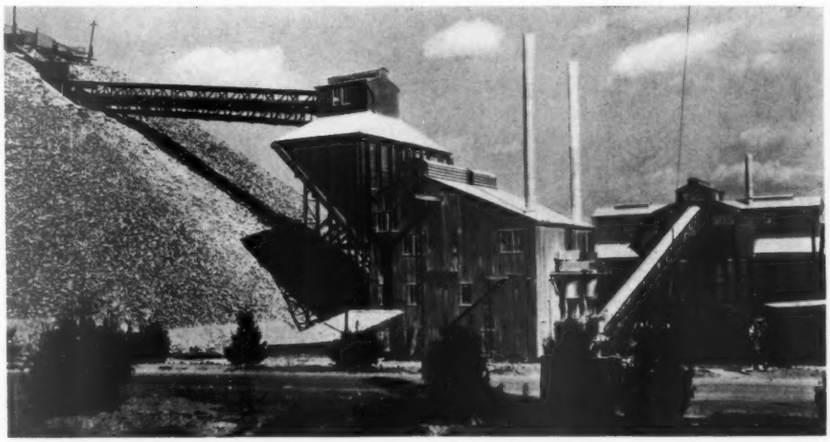
Coming Events

August 29-September 3, 1938, Grand Rapids, Mich.— Power Show and Mechanical Exposition, National Association of Power Engineers, Civic Auditorium.

September 30-October 1, 1938, Urbana, Ill.—Sixth Annual Illinois Minerals Conference, University of Illinois.

October 10-11, 1938, Chicago, Ill.— National Safety Congress and Exposition, Stevens Hotel.

November 30-December 2, 1938, Washington, D. C.—Eighteenth annual meeting, Highway Research Board, National Academy of Sciences Bldg.



This plant, located near Johannesburg, South Africa, is one of the important crushed-stone producers in the transvaal. Conveyor belts in the two galleries, and this photograph, were furnished by the Manhattan Rubber Mfg. division of Raybestos-Manhattan, Inc.

EDITORIAL

The New Wages and Hours Law

WITHIN a few months the United States will begin its first attempt to raise the standards of living on a national scale. Legislation popularly known as the "wages and hours" law will then become operative, and the great majority of American industries will feel the effects of a national movement designed to improve the economic well-being of millions of people. While there may be much reason for hoping that the Supreme Court will declare this law to be unconstitutional, there is little reason for expecting that it will be so judged, because it harmonizes with the changing social philosophy of that court as this has been expressed in recent decisions.

In its objectives this law is typical of modern social legislation in that it gives effect to principles that are winning ever-wider acceptance as fundamentals necessary to the establishment of a satisfactory economic order. It embodies the ideas long advocated by reformers and revolutionaries and those long ago adopted by European countries more advanced in their social policies. It gives partial effect to the contentions of those economists who have urged the necessity of increasing progressively the total amount of the national income to be divided, if higher living standards for everyone are to be attained. It provides machinery for making alterations in the distribution of income from time to time, a matter which Harold G. Moulton has described as "of primary significance not for its momentary effects upon the well-being of the masses, but for its possible cumulative effects in promoting a fuller utilization of our productive facilities and a consequent progressive increase in the aggregate income to be available for distribution". It coincides with some of the stated aims of organized labor and so, paradoxical though it may seem, has earned the opposition of labor bodies, because it has weakened one of their strongest pleas for membership. It will not be opposed by those employers who have come to see the ultimate advantages to production-for-product of an adequately-fed, properly-housed, well-educated, continuously-employed, and psychically satisfied working class. It is not in conflict with the American philosophy of equality, since it aims to lessen the differentials between those who are fairly well paid and those who are grossly underpaid. Despite its inadequacy and other imperfections—shortcomings which are part of all legislation—this law may in time come to be recognized as an important step forward in bettering the relations between classes which have heretofore been too widely separated by differences in opportunities, privileges, responsibilities, incomes, and psychical satisfactions.

The regulation of hours and wages in industry is new in this country only in its having been given national dimensions in this law. Nearly 150 years ago a movement for a shorter working day for men was initiated by union carpenters in Philadelphia in an effort to distribute employment opportunities more widely, but no legal attempt to shorten the working day was made until 1840, when, in a period of industrial depression, President Van Buren by executive order stipulated a 10-hour day in government navy yards, while 11-hour and 12-hour days were the rule in private industry. Twenty-eight years later the Congress passed a law providing that "eight hours shall constitute a day's work for all laborers, workmen, and mechanics who may be employed by or on behalf of the government of the United States". The omission of any prohibition of agreements for overtime work made it ineffective, and the situation remained unchanged until 1892, when a more effective law, applying also to contractors and subcontractors but not to the manufacturers of many materials and articles purchased by the government, was passed. In 1912 a law of wider application was enacted, and a year later dredging and rock-excavation in rivers and harbors of the United States, which had been excluded from the 1892 law by a Supreme Court ruling, were brought under the operation of the federal act. Federal legislation of the last few years has broadened the applicability and strengthened the effectiveness of the old principles.

DURING the Civil War period the movement for legal control of the hours of labor in private employment became important largely through the efforts of Ira Steward, who started a nationwide effort for universal application of the 8-hour day. As a result several states passed laws, although these were not enforceable. Most of the progress that has been made in shortening hours has been accomplished through collective bargaining, despite the fact that the American Federation of Labor at its conventions of 1914 and 1915 voted against the 8-hour day largely on the ground that legislation limiting maximum hours might lead to laws fixing minimum hours. The opposition of the federation to the present law is therefore consonant to its former attitude.

The idea of fixing a minimum wage in private industry by law is at least as old as the French legislation of 1270, but it did not receive in either England or America the support of some labor organizations, largely because of the fear that legally-set minimum wages would tend to become maximum wages. Some strong unions have approved the principle but with misgiving about its tendency to weaken the opportunities for increasing union membership. The latter attitude has been a factor in the opposition of the A. F. of L. toward the present law. Since 1912, when Massachusetts passed the first minimum-wage law applicable to women and children, fourteen states, the District of Columbia and Puerto Rico have enacted such legislation. But the Supreme Court's adverse decision in 1923 reversed the previous favorable decision in the case of Oregon in 1917, and the movement seemed to be effectively checked for a time. However, various codes under the National Industrial Recovery Act greatly stimulated interest in and support for the principle of minimum-wage regulation and hastened the passage of the present law, which, by regulating both hours and wages and by making its provisions applicable to men, women and children, seeks to attain in a single piece of legislation several objectives that are held to be socially and economically desirable.

NOT all advocates of this type of industry regulation have been activated by selfish motives. The real father of the theory that shortened working hours will improve the hygienic, cultural and social conditions of the working classes was an English manufacturer, Robert Owen, who as early as 1833 prepared for the Society for Promoting National Regeneration a number of arguments favoring the 8-hour day. He insisted that technological progress had, even then, made the working of longer hours unnecessary and that productivity could "under appropriate arrangements" be increased by reducing the number of hours. Later studies of factory methods made in the early years of this century demonstrated the truth of what was with Owen only a belief. He contended, too, that it is in the interest of every human being to maintain among the entire population a state of happiness, a sense of moral values, intelligence and health and that, in the case of the average worker, more than eight hours of work will impair these hygienic and social qualities. In an 8-hour day, he thought, it would be possible to produce a sufficiency of all types of commodities for everyone.

The enactment of minimum-wage legislation in other countries has had immediate and beneficial effects on the workers who are affected by it, but there is disagreement as to the general economic effects of such regulation. For example, it is alleged by its opponents that rigid regulation of industry and fixed wage rates hamper its development, that unemployment is not lessened (as in Great Britain, for example, after the World War), that the differential between the wages of skilled and unskilled workers is reduced, and so on. On the other hand its supporters assert that relative fixity of labor rates has not affected industry adversely, that wage regulation is only one factor among many factors affecting post-war unemployment, and that the narrowing wage differential is attributable mainly to a reduction in the demand for skilled workers and to a rise in educational standards. Experience with our new law may determine whether legislation raising the minimum wage rate has a permanent elevating effect on the wages of all workers, a question which has not yet been clearly answered by the results observed in other countries.

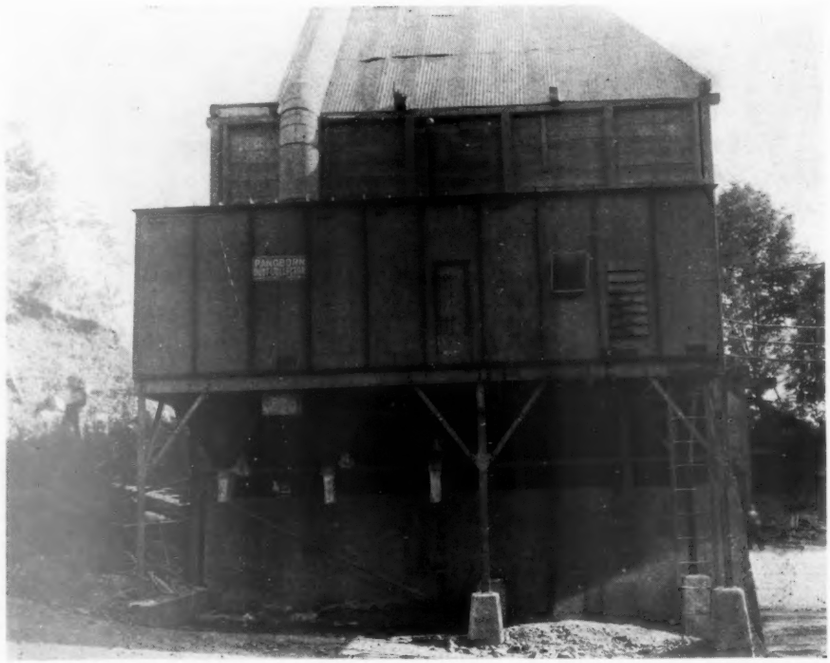
THE new wages and hours law should have a tendency toward the reduction of industrial strife and the economic burdens which conflicts over wages and hours necessarily entail. It reduces the opportunities for friction in those cases where existing wages are below the levels fixed by the law and where the number of hours of labor exceeds the maximum set by it. Despite the terrific cost of the strikes and lockouts that have resulted from disputes about wages, organized labor has made small gains in its struggle for higher pay. Its union membership in 1930 constituted less than seven per cent. of the 49,000,000 workers who were gainfully employed in that year, partly attributable to, and partly the cause of, the little progress made. Increases in wages and the reductions in hours sought by labor organizations are resisted by employers because of their fear that their acceptance will place them at a serious disadvantage competitively, and similar fears may check a whole industry that is competitive with other industries. Employers generally see no immediate gain to themselves through increasing the purchasing power of their employees as an offset to accepting an increased wage burden, so concessions to the theory of the economic advantages of higher wages and shorter hours are made only under pressure.

National legislation appears to be the only way by which the competitive disadvantages resulting from one employer's paying higher wages or working shorter hours than another can be avoided and by which greater general purchasing power, with its attendant benefits on all industries, can be made a reality. Industrial, geographical, occupational and social differentials will tend to shrink as the leveling-out results of uniform, nationally-applied standards become effective.

By W. E. TRAUFFER

Trap-Rock Producer Abolishes Dust With Complete Collecting System

A view from the quarry side of the plant with the crusher hopper at left. Note the dust-collection pipes.



The dust-collecting unit which is connected to all equipment in this plant including crushers, screens, elevators, etc.

THE dust problem is one which has for many years been a growing source of annoyance to many producers of nonmetallic minerals and their neighbors. This has been especially true in the crushed-stone industry, where a large percentage of the plants are located fairly close to their major markets, the larger cities, which have been steadily expanding and building up around these plants. Specifications have also become stricter regarding dust in stone and of late years the bugaboo of silicosis and other pneumoconioses has helped to keep the crushed-stone producer from getting a good night's sleep, especially if his deposit contain an appreciable amount of free silica.

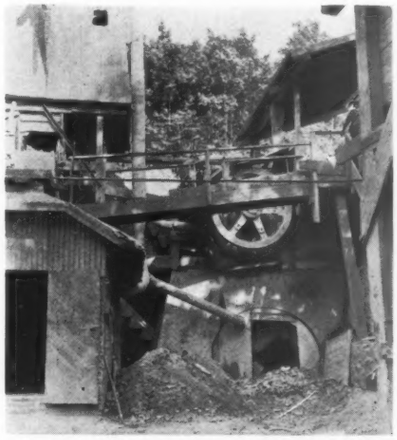
One company which seems to have solved this problem is the Foxon Trap Rock Co., which operates a crushed-stone plant just northeast of New Haven, Conn., in a section which is now fairly well settled. This company bu'lt its original plant in this location in 1926. In 1936 the plant was improved by the installation of a cone crusher and three vibrating screens, and now has a capacity of about 80 tons per hr. At the same time the company began washing its product, using the water from a near creek. This method, however, caused too much contamination of the creek and had to be discontinued. The company then tried buying its water from the city of New Haven, but when it was found that this cost about $350 per month some other solution of the dust problem was sought.

Late in 1937 the company installed a Pangborn Type CH cloth dust-collector and connected this to every operating unit in the plant. According to E. J. Clogher, in charge of operations, the stone sold is now almost dust-free, whereas formerly after a long haul the bottom of a truck body would be full of the dust shaken off the stone in transit. This installation collects about 2 cu. yd. of dust daily and the writer noticed that the amount of dust escaping from the plant when in full operation was hardly enough to be appreciable.

Interior view showing dust-collecting connection at discharge point of conveyor.

The dust-collector is connected to the discharge of the two crushers which are fully inclosed. It is also connected to the three vibrating screens, which are also fully inclosed, to the discharge from the second elevator to the return belt-conveyor, and to the discharge end of this conveyor. A Sturtevant fan driven by a 25-hp. motor provides the suction for this system.

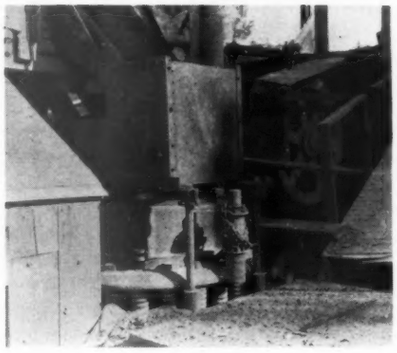
The company's deposit is in the trap rock found in this part of New England. Blasting is done by means of tunnels and gopher or snake holes. A Type 7 Marion steam shovel loads the stone into two trucks, which haul it downgrade to the plant. The trucks back up to discharge into the Farrel-Bacon 24-in. by 36-in. jaw primary crusher. A bucket-elevator feeds the crusher prod-



Another view of the two crushers showing their dust-collecting pipes.

uct to a Nordberg-Symons 3½-ft. by 10-ft. 2-deck screen used as a scalper. The coarse material retained on this screen is usually discharged into a 3-ft. Symons cone crusher, but it can also be discharged with the material passing through the screen to a bucket-elevator. The product of the cone crusher is also discharged to this elevator, which feeds a 4-ft. by 19-ft. Robins 2-deck heavy-duty screen. This screen has 2¾-in. openings on the top deck and 1⅝-in. openings on the bottom deck. The oversize drops on a belt-conveyor which returns it to the scalping screen. The stone retained on the bottom deck is No. 1 and goes to a bin.

The material passing through the bottom deck goes to a Nordberg-Symon 3½-ft. by 10-ft. 2-deck screen with 1-in. openings on the top deck and ⅝-in. and ¼-in. openings on the bottom deck. This screen produces No.



The 3-ft. cone reduction crusher with the jaw primary crusher in background.

2, 3 and 4 stone and dust, each going to a separate bin. By adjusting the crusher openings and changing the screen cloth it is possible to reduce the entire product of the plant to maximum sizes of 2 in., 1½ in., or ¾ in. as desired. Both sizing screens are suspended by cables.

Stone is stored in six bins having a total capacity of 600 tons. All the deliveries are made in trucks which are loaded under the bins. The company owns a 6-ton Model C50 International truck, a 10-ton Four-Wheel-Drive truck, two 8-ton Model AC Mack trucks and a Ford truck. The Mack trucks are used in the quarry and the others for deliveries. All the shipments are weighed on a New Haven truck scale.

Some stone is also shipped by water to points on Long Island Sound from a dock on the Quinnipiac River. Trucks dump the stone into a 16-ton hopper from which a belt-conveyor feeds a sta-

One of the sizing screens showing full inclosure and dust-collecting pipes.

One of the truck-mixers being loaded under the batching plant.

tionary washing screen equipped with 12 Link-Belt spray nozzles. A 20-in. belt-conveyor on a 30-ft. boom is supported on a circular track and discharges through a swivel chute into barges. The company owns two deck scows of 1,000 tons capacity each and hires the towing.

A large stock-pile of stone is built up near the plant during slack seasons and this is drawn upon during busy seasons, when the demand exceeds the capacity of the plant. The company also operates a small sand plant and some of the sand produced by it is stored alongside the plant in a bin from which trucks can be loaded for delivery or for the concrete plant. The company is also engaged in contracting.

The company began the production of ready-mixed concrete about five years ago and now operates three Chain-Belt Rex. 1½-cu. yd. truck-mixers mounted on Ford chassis. The concrete plant is located in an abandoned quarry below the present one and between it and the stone plant. Stone and sand are hauled by trucks from the bins up the quarry road and are discharged direct into the concrete-plant bins. A Johnson batcher with a 3-beam scale is used for the aggregates. Cement is added from sacks.

Is Granted Trade-Mark on Stabilized Material

The trade-mark "Roadcrete," covering the production of plant-mixed road material stabilized with calcium chloride, has been granted Roadcrete, Inc., of Cincinnati, O., a subsidiary of the Ohio Gravel Co.

The company is now prepared to license its use to other aggregates producers, according to Earl Zimmerman, representative.

By P. J. FREEMAN

Cement, Concrete, Lime and Aggregates Research Recorded at A.S.T.M. Annual Meeting

THE forty-first annual meeting of the American Society for Testing Materials was held at Chalfonte-Haddon Hall, Atlantic City, and although the attendance was not quite equal to that of the meeting held in New York City last year, it was equal to the attendance of the 1936 meeting in Atlantic City, with a registration of about 1,150. Having been a regular attendant at such meetings for 20 years, I am inclined to compare present-day meetings with those which I first attended. It is my recollection that in 1918 we not only had time during one week to handle all the business of the A.S.T.M., but also attended meetings of the American Concrete Institute. During the past 20 years it has been my privilege to serve on a number of committees covering metals, cement, bituminous and other materials, and in the early 20's it seemed easy to keep in fairly close touch with the work of the main committees, and also attend general sessions. This statement is made for the benefit of the newer members, and others who have not realized the enormous development which has taken place during the past few years in the organization of new committees for the standardization of specifications and methods for testing. It is no longer possible for an individual member, or a representative from a company to keep in touch with the activities of the main committees, and I am impressed with the fact that even as a personal member, I should have had assistance in covering the range of my own interests. One has the feeling of passing down the line of a big cafeteria during the rush hour and endeavoring to select choice bits of sustenance, knowing that it will be a whole year before he is permitted to pass that way again. This is in no way a criticism of the activities of the society, but decidedly the reverse, to point out that the development of recent years is such that the members will have to bring additional representatives or be reconciled to missing reports on many informal committee meetings.

There were seventeen separate technical sessions, at which 104 papers and reports were presented. During the week 220 committee and subcommittee meetings were scheduled in the printed program, and an unknown number of additional committee meetings were held. It is this tremendous pressure of committee and subcommittee meetings which makes it impossible for an individual to attend all those of a session, and at the same time keep up with necessary committee work. I found myself obliged to withdraw from many meetings, consequently in reporting my impressions of the annual meeting, it will be necessary to omit many worthwhile papers, because I was unable to hear them presented.

At the formal opening session on Tuesday, June 28, the names of the new officials were announced. Dr. T. G. Delbridge, manager of the Research and Development Department, Atlantic Refining Co., will be president next year, following the retiring President, Prof. A. E. White, of the University of Michigan. A new vice-president will be Dr. W. M. Barr, chief Chemist and Metallurgist of the Union Pacific Railroad.

At the annual meeting a year ago it was announced that three honorary members, each a past-president of the society, had been elected, namely, J. A. Capp, G. H. Clamer, and G. W. Thompson. At the recent meeting additional honorary memberships were awarded to Dr. Frank O. Clements, technical director, General Motors Laboratory, Prof. William K. Hatt, Purdue University, and Prof. Herbert F. Moore, University of Illinois. In 1923 Dr. Arthur N. Talbot, Prof. Emeritus, University of Illinois, was elected an honorary members. The society now has six honorary members, the death of J. A. Capp having been recently announced.

The annual award of the Charles B. Dudley Medal was made to R. H. Heyer, Research Department, American Rolling Mills, for his paper delivered last year on *Analysis of the Brinell Hardness Test*. The annual Marburg Lecture was delivered by Prof. Albert Sauveur on the subject of *The Torsion Test*. Those persons who are familiar with the published works of this distinguished metallurgist will realize the importance and interest which is attached to any subject on which Prof. Sauveur prepares a discussion.

Portland Cement.—Committee C-1 on Cement, P. H. Bates, chairman, presented a lengthy report, and held two important meetings which were attended not only by members of the committee, but by many representatives from the cement companies. An important item presented to the committee was that of a *Proposed Method of Test for Autoclave Expansion of Portland Cement* by the Working Committee on Volume Change and Soundness. This subcommittee has been carrying out a program of tests, and the results of the many coöperative tests are published as a part of the Report of Committee C-1. The data are too extensive to make it desirable to discuss these results at this time. To the *Report of Coöperative Autoclave Tests on Cement* there is added an outline of *Coöperative Studies of Autoclave Tests on Portland Cement* which may be used for future investigation in connection with the proposed method of test.

For those who are not familiar with the autoclave it is sufficient to state that neat cement bars, 1 in. by 1 in. square and 10 in. long, are prepared and cured for 24 hr. At the end of that period they are placed in an autoclave (which is simply a high-pressure boiler) and the temperature and pressure are raised to maxima of 420 deg. F. and 295 lb. per sq. in. respectively. The time of heating and cooling is prescribed under the proposed test method. The difference in the length of the test specimen before and after autoclaving, expressed as a percentage of the effective gage length, is the result obtained from the test; in addition, any warping or other signs of unsoundness will, of course, be noted.

The purpose of this test is to detect unsoundness in cements, regardless of the cause, but unfortunately we do not have a long record of experience in

service to check against results obtained from the autoclave test. The results of laboratory tests and a general survey of the data available seem to indicate that for most cements the autoclave test will represent the behavior of such cements when exposed to atmospheric conditions. The members of Committee C-1, however, were unwilling to adopt any specification limiting the amount of expansion for such bars, even though it was proposed that a maximum of 0.75 per cent. be used. Most highway engineers feel that a maximum of 0.25 per cent. is almost too much, whereas many producers think that 1 per cent. is entirely adequate for the protection of the consumer. After deliberating for several hours it was finally decided to omit all reference to the percentage of elongation, or specification requirements, but accept the proposed *Method of Test for Autoclave Expansion of Portland Cement* and start it on the way towards adoption as a tentative method, and this may or may not be completed before the next annual meeting.

Definition of Portland Cement.—when the committee prepared *Standard Specifications for High-Early-Strength Portland Cement (C 74-36)* it obligated itself to revise the *Standard Specifications for Portland Cement (C 9-37)* in so far as the question of a definition for Portland cement was concerned. The committee submitted for immediate adoption a revision of that definition, so that now the two standards for Portland cement are in agreement on the question of admixtures. This is a matter of considerable importance to producers and consumers, as the new definition permits the use of additions in quantities less than 1 per cent., subsequent to calcination of the clinker, of other than water and/or untreated calcium sulphate, if such additions are found not to be harmful by tests prescribed and carried out by Committee C-1.

About 1936 a special Subcommittee on Tests of Additions to Cement, consisting entirely of testing engineers, was authorized by Committee C-1 and instructed to make such tests on admixtures as requested by the producers of those materials. This subcommittee, under the chairmanship of Dr. Inge Lyse, has reported concerning one such addition, which was found not to be harmful. This material is basically known as a mixture of highly-purified salts of calcium lignin sulphonic acid and of tri-ethanol-amine, which is sold under the trade name of TDA. The subcommittee reported that when interground with high-early-strength Portland cement in amounts not exceeding that tested in their study, which was approximately 0.14 per cent., it was not harmful. In so far as this material is concerned, it is now acceptable under the *A.S.T.M. Specifications for High-Early-Strength Cement.* Presumably the cement manufacturers will use various methods for printing statements on each bag whenever this material is used in manufacturing the cement.

Fineness of Cement.—The recent action of Committee C-1 brings the A.S.T.M. Standard Specifications for High-Early-Strength Cement and regular Portland cement into conformity with each other, in so far as fineness is concerned, and neither specification has any requirement for fineness. This action is in line with the thought that the fineness of a cement is a detail of manufacturing which is of much importance to the producer and, although it is reflected in the physical properties of the cement, it is adequately covered so far as the user is concerned by the several physical requirements. Although this action, beginning in 1937 with regular Portland cement, has the committee's approval, it seems doubtful to me if users of cement will remain satisfied with the omission of a fineness requirement. The large user, particularly where such cement is manufactured under special specification requirements, feels that he should know the surface area of the cement in order to enable him to predict the strength from tests made at the earlier ages, and at the same time form a basis for better knowledge of the behavior of the cement in concrete with regard to bleeding. It is my prediction that a requirement for fineness will again be included in the specifications of the A.S.T.M. and that it will not be dropped from specifications prepared by large consumers for the construction of mass concrete, nor by organizations such as state highway departments. In general conversation among the cement producers and consumers the surface area as determined by means of a turbidimeter is regularly used, and probably more often than any other characteristic of the cement, even though fineness is no longer recognized as an "essential property" to be covered by specifications.

In spite of the fact that Committee C-1 does not have a specification requirement for fineness, the *Tentative Method of Test for Fineness of Portland Cement by Means of the Turbidimeter (C 115-34T)* was revised and improved so that a standard method is available for determining the surface area. Although it was not a part of the report of Committee C-1, it seems appropriate to mention at this point a very excellent paper on *Studies of the Operation of the Wagner Turbidimeter* by H. S. Ponzer and D. R. MacPherson of the Portland Cement Assn., which was presented at a general session. One must read this paper in order to appreciate the careful work which was done by the authors in preparing it. The various procedures to be used in standardizing and operating the turbidimeter are discussed, and the results obtained under various good and bad conditions are presented. Of particular interest to me is the statement that kerosene should never be re-used, regardless of whether or not it is filtered. It has been my practice to discard all kerosene after being used once without any attempt to filter it, and in view of the fact that it means using a considerable number of drums of kerosene each year, I have suffered occasional twinges of conscience that the practice might be unnecessary as well as uneconomical. The paper apparently clears up this point. It is also pointed out that the results may be affected by the temperature of the kerosene. With care and attention to methods of operation, it is the authors' conclusion that the Wagner turbidimeter appears capable of giving results reproducable within about $\pm$ 1 per cent. of the average.

Methods of Chemical Analysis.—The Working Committee on Methods of Chemical Analysis presented a completed report on *Methods for Sodium and Potassium Oxides,* which is set forth in detail in the printed report of Committee C-1. Recommendations were also made by the Working Committee concerning *Methods for Magnesia* and *Methods for Manganic Oxide and Phosphorous Pentoxide,* and it is continuing its work on *Methods for Free Lime* which were outlined a year ago. *Tentative Methods of Chemical Analysis of Portland Cement (C 114)* were also adopted.

Plastic Mortar Tests.—The Working Committee on Plastic Mortar Tests presented an extensive report showing the results obtained from the tests which were outlined in 1937, and following up the 1934 series of tests. The work of this subcommittee is important in connection with the frequently-expressed desire on the part of many engineers to have a specification for cement which will predict its concrete-making properties.

Concrete and Concrete Aggregates.—Committee C-9 on Concrete and Concrete Aggregates, R. W. Crum, chairman, reported the adoption of new tentative standards as follows:

(1) *Method of Test for Determination of Yield of Concrete.*

(2) *Method of Test for Sieve Analysis of Fine and Coarse Aggregates.*

(3) *Method of Test for Soundness of Aggregates by Freezing and Thawing.*

The first test is designed to standardize the procedure for determining the yield of concrete in the field, the yield being expressed in terms of cubic feet of concrete per 94-lb. sack of cement.

The second tentative method of test represents the joint activities of Committee C-9 and Committee D-4, and seems to mark the end of a long controversy between the two committees relative to the standardization of a method of sieve analysis.

The Tentative Method for Soundness of Aggregates by Freezing and Thawing will undoubtedly be of service in helping to standardize this widely used method for testing aggregates. In view of the fact that in may localities rock which is unable to withstand the action of sodium *sulphate* or magnesium *sulphate* has been found to produce durable concrete in service, the need for another method of testing has caused the development of freezing-and-thawing laboratories throughout the entire country, no two of which seem to use similar methods. No doubt the tentative method is far from satisfactory to many testing engineers, but it will at least form a basis for constructive critcism, and help to develop a definite procedure throughout the country. The cost of a complete freezing-and-thawing laboratory is not excessive in comparison with what is frequently expended for a compression-testing machine, and when it is considered that such equipment may also be used for studying the quality of concrete as well as the soundness of aggregates, it seems probable that freezing-and-thawing equipment will become as standard apparatus in materials-testing laboratories as the rattler and the compression machine.

Attached to the report of Committee C-9 are three papers which are well written, and since they bear the sponsorship of the committee they are recommended for study as being of particular interest to users of concrete:

Stress-Strain Characteristics of Mortars and Concretes by H. J. Gilkey and Glenn Murphy, submitted by Subcommittee VI on Relation of Characteristics of Materials and Mixtures to Properties of Concrete.

Some Observations on the Diffusion of Water Vapor Through Concrete by H. J. Barre, submitted by Subcommittee VIII on Permeability Tests of Concrete.

Factors Affecting the Testing of Concrete Aggregate Durability by Charles E. Wuerpel, submitted by Subcommittee XVII on Conditions Affecting Durability of Concrete in Structures.

Sanford E. Thompson Award.—A special subcommittee headed by H. J. Love received the approval of Committee C-9 to establish what is to be known as the Sanford E. Thompson Award for the Most Meritorious Paper on Concrete or Concrete Aggregates. Committee C-9 has a fund of several hundred dollars which may be supplemented by additional contributions, from which an award of $50 is to be made at intervals for a paper presented through the auspices of Committee C-9. The details for receiving the papers and making the award are being handled by the secretary of the society. Sanford E. Thompson was the first chairman of Committee C-9, and served for many years in that capacity, and to me is seems a very fitting tribute from the committee to a man who served so faithfully, and contributed so much to the history of concrete.

Road and Paving Materials.—Committee D-4 on Road and Paving Materials, F. C. Lang, chairman, adopted a number of new *Tentative Standards on Methods of Test for Sieve Analysis of Fine and Coarse Aggregate,* which represented joint agreements with Committee C-9. Committee D-4 also adopted a number of *Tentative Specifications for Tar,* which represents a codification and clarification of existing specifications.

The *Tentative Method of Test for Abrasion of Coarse Aggregate by Use of the Los Angeles Machine (C 131)* has been amended and improved through joint action with Committee C-9. The Los Angeles rattler, as it is commonly called, has come into unusual popularity, and appears about to supplant entirely the Deval abrasion machine on account of the shorter time required for the test and the fact that a graded sample of aggregate may be used in place of the specially-selected pieces required for the Deval test.

Committee D-4 also approved the following new Tentative Standards:

(1) *Specifications for Crushed Stone for Waterbound Base and Surface Courses* to replace *Specifications D 190-29T* and *D 191-29.*

(2) *Specifications for Crushed Slag for Waterbound Base and Surface Courses* to replace *Specifications D 65-23 and D 66-23.*

(3) *Specifications for Crushed Stone for Bituminous Macadam Base and Surface Courses (D 192-38T)* to replace *Specifications D 192-29.*

(4) *Specifications for Crushed Slag for Bituminous Macadam Base and Surface Courses* to replace *Specifications D 195-27* and *D 159-27.*

(5) *Specifications for Crushed Stone for Bituminous Concrete Base and Surface Courses* to replace *Specifications D 193-29T* and *D 194-29.*

(6) *Specifications for Crushed Slag for Bituminous Concrete Base and Surface Courses* to replace *Specifications D 196-27, D 161-27,* and *D 160-27.*

Lime.—Committee C-7 on Lime, James R. Witherow, chairman, withdrew the soundness test from *Tentative Method of Physical Test for Limestone, Quicklime, and Hydrated Lime (C110-34T)* which has been carried for some time. This test is an accelerated autoclave method, and study by the committee indicated the desirability of withdrawing the method from the specification. The action of the Committee on Lime in withdrawing its autoclave test is in line with the refusal of Committee C-1 on Cement to adopt specifications for such a test, although the two committees are entirely independent of each other.

Soils for Engineering Purposes.—Committee D-18 on Soils for Engineering Purposes, H. F. Clemmer, chairman, is a lusty infant which seems to be on the way toward becoming a large and important part of the society. For the present the committee is concerning itself with methods for testing soils, and it is expected that when C. A. Hogentogler, Sr., who is now attending the International Road Congress in Europe, returns, the committee will receive many new ideas and suggestions for additional development in procedure and methods. Although there is a wide variation between samples of soil collected within close proximity of each other, nevertheless it seems probable that methods will be developed for treating such soils to stabilize them for various purposes, and in view of the fact that Committee D-18 will be called upon to deal with specifications concerning the use of commercial products, such as cement, tar, asphalt, sodium chloride, calcium chloride, and no doubt many other materials not now thought of, it is my prediction that this committee will have a very active and important future, and it would be good for all persons interested in foundations, subgrades, and earthwork construction to keep in touch with the work of the Committee on Soils for Engineering Purposes.

In connection with the general session on soils four papers were submitted dealing with that subject. Dr. O. E. Rhoades of the Koppers Co. is making studies of soils in a pug-mill mixer, in which the relation between the kneading torque and the water content is charted in somewhat the same way as that in which attempts have been made to measure the workability in a concrete mixer by measuring the energy absorbed in the process.

General Sessions.—A total of 104 techincal papers and reports were pre-

sented before the 17 general sessions of the society, several of which were simultaneous, and, in general, each session followed a particular central theme or subject with the papers grouped around it. Two sessions were devoted to a Symposium on Impact Testing of Metals. An entire session was assigned to Radiography, which is a comparative newcomer to the society, the importance of which is emphasized by the fact that a new committee, E-7, has been created to take over this work. Likewise papers on Spectography brought out the work being done by spectographic analysis, and although the readers of this magazine may not in general be interested in this subject, it should be pointed out that the possibilities for determining the properties of metals seem to be unlimited.

Water was the subject of an entire session, and even then the possibilities of developing more knowledge concerning this important material were not exhausted. The customary sessions on tests of ferrous and non-ferrous metals, bituminous and petroleum products, concrete, and many other miscellaneous materials were covered by adequate reports and papers.

A paper by T. C. Powers, of the Portland Cement Assn., on *Measuring Young's Modulus of Elasticity by Means of Sonic Vibrations,* opened new possibilities for studying concrete. It is a well-known fact that the use of a compressometer for determining the modulus of elasticity of concrete leaves much to be desired, both as to the ease of operation and the reliability of the results obtained. The sonic method takes advantage of the well-established principle which may be found in any complete text book on sound that the modulus of elasticity may be calculated for a material when the dimensions, density, and frequency of vibrations are known. The author states that the method has been applied to such building materials as tile, slate, brick, lead, ebonite wall-board, paraffin wax, rock asphalt, and asphalt mastic. The frequency of vibration is determined by striking a prism with a mallet and comparing the pitch of the fundamental tone obtained from the prism with a musical instrument or calibrated wire, from which the frequency of vibration may be determined with reasonable accuracy. I was particularly interested in this scientific development and exposition of a test which I have used for years for judging the quality of concrete from the ring produced by a hammer, but I never suspected that I was determining the comparative values of Young's modulus by a method which I liked to call my "ax test".

Prof. Roy W. Carlson presented a paper in the nature of a progress report on a long-range program of research aimed toward a better understanding of concrete shrinkage. This paper discussed the shrinkage and invisible cracking of mortar between aggregate particles when concrete is subject to drying. The author is studying the effect on concrete shrinkage when different materials are used for the aggregate, such as quartz, feldspar, dolomite, limestone, hornblend, slate, sandstone, granite, etc. This work may be correlated with that of Prof. Otto Graf of the Technischen Hochschule, Stuttgart, who has been studying the behavior of such aggregates when subjected to drying and temperature changes. Among 17 tentative conclusions given by the author, the following are selected at random.

"The cement paste in ordinary concrete, if unrestrained by the aggregate, would shrink from 5 to 15 times as much as does the concrete."

"Size of aggregate, below a limiting size, does not affect concrete shrinkage unless it affects the water requirement."

"The relative compressability of aggregate particles appears to be the most important factor causing different aggregates to produce concretes of different shrinkage."

"Particle shape of aggregate has little effect on concrete shrinkage except as it determines the amount of mixing water that must be used."

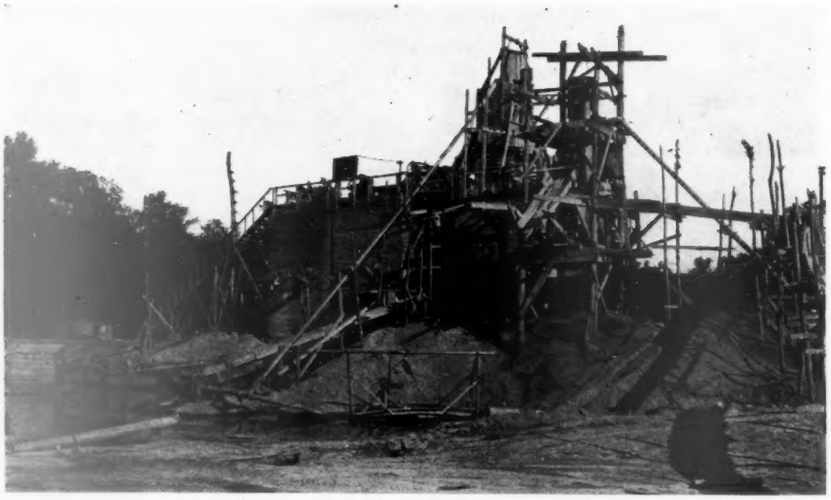
"Cracking of cement mortar between aggregate particles is believed to be a factor contributing to the low over-all shrinkage of many concretes."

Prof. Raymond E. Davis presented a paper, prepared jointly by himself, Elwood H. Brown, and J. W. Kelly, on *Some Factors Influencing the Bond Between Concrete and Reinforcing Steel.* This paper is an additional contribution to what, in my opinion, is a much-neglected subject. The authors point out that the bond strength varies greatly with the type of cement, and that the bond strength is also increased by delayed vibration or jigging during the setting period of the cement, and greatly decreased by repetitions of freezing and thawing or wetting and drying. It is further stated that, "Since the bond strength may be seriously impaired while the compressive strength may be affected only to a minor degree, a lower working stress in bond may be necessary for members exposed to the weather or to large variations in temperature, than for those members which are protected". It is also stated that, "Consideration of the wide departures from any fixed relationship between bond strength and compressive strength of concrete such as are now commonly employed in construction, and consideration of those factors which may have little effect on compressive strength but a large effect on bond strength would make it appear questionable whether the working stress in bond should be based solely on the compressive strength, and would point to the desirability of basing the working stress on the results of a standard bond test".

A paper on *Short-Time Creep Tests of Concrete in Compression* by Russell S. Jensen and Frank E. Richart, brought out more interesting information concerning this important subject. To those persons who feel that masses of concrete remain identical in dimensions during all time and conditions of loading, it is recommended that a study be made of the work being presented by the authors of this paper, as well as information on the flow of concrete published by the American Concrete Institute. The tests reported were made to study the creep that occurs in concrete compression in relatively-short periods of time, varying from 1 to 30 min., under various intensities of stress. The fact that the flow of concrete may be detected under the conditions set forth in this paper seems to add to the possible advantages which may be obtained through the further development of the tests for determining the modulus of elasticity by means of sonic vibrations rather than by the time-honored compressometer method.

In spite of the fact that Committee C-1 on Cement has been unable to produce a satisfactory specification for blended cements, that subject is still of interest to the users of concrete. A paper by W. F. Kellerman and D. G. Runner, of the Bureau of Public Roads, on *The Effect of Using a Blend of Portland and Natural Cements on Physical Properties of Mortar and Concrete* was received with interest and attention. The authors described the tests made both in the laboratory and in the field in connection with the construction of four concrete pavements in New York State, in which blends of Portland cement and natural cements were used. The subject is of particular interest to people in cold climates where a large number of alternate freezings and thawings occur in the pavements, and where salt solutions are used for removing the ice. These tests indicated that, "Whereas strength was reduced by replacing a portion of the Portland cement with natural cement, resistance to alternate freezing and thawing was, for certain combinations of materials, substantially increased."

By W. E. TRAUFFER



The plant with dredge pipe-line and scalping tower at right. The rehandling pump is at left.

ANGULAR GRAVEL FROM GEORGIA SWAMP

The dredge which has been used by the company since it first began operations.

JUST a little over three years ago a new sand-and-gravel plant was put in operation in the swampy old bed of the Savannah River. This plant, owned by the Carolina Sand & Gravel Co. of Augusta, Ga., was then located about 12 mi. southeast of Augusta, near Kathwood, S. C. In spite of many predictions that the natural obstacles of swamp, trees, underbrush, floods, etc., could not be overcome, operations were carried on successfully at this location from early 1935 until October, 1937, when the deposit became exhausted. A complete description of this operation was published in the August, 1935 issue of PIT AND QUARRY.

The entire operation was then moved about 1 mi. downstream to a new deposit, where a new dredge pond has been opened. There is enough material in this deposit for another three years of operation. Conditions here are, if anything, even worse than in the former location. The clearing operations might well be called logging from the size of some of the trees observed by the writer which will have to be removed. After the trees and underbrush are removed the overburden is also stripped from the deposit.

As a reward for the difficulties surmounted in obtaining this material the company enjoys a freight-rate advantage in shipping to Augusta, southern South Carolina and northern Georgia. The nearest competitor of importance is about 100 mi. to the northeast and no serious gravel competition exists for 200 mi. or more in any other direction. The chief competitor of this product is the crushed granite produced in South Carolina and Georgia. The gravel is quite angular, due, it is said, to the fact that it had not been carried far from its source. According to F. I. Gibson, vice-president and general manager of the company, the gravel has a Los Angeles rattler test of 40 to 43 at 500 revolutions. Considerable material is sold to the South Carolina highway department for bituminous surfacing.

Since last described the dredge has been changed considerably. An 8-in. Georgia Iron Works pump has replaced the pump originally installed and it is driven through V-belt by the same 104-hp. Caterpillar Diesel engine. A smaller Georgia pump, used to prime the dredge pump, is driven by a Hercules gasoline engine. The 30-ft. suction nozzle is now operated from a 4-drum Ersted hoist, which is driven through a clutch from this gasoline engine. This hoist also operates the shore lines. The Diesel-driven generator for shore-plant power which was formerly on the dredge has been moved to the shore. The engine formerly used has been replaced by a McCormick-Deering Diesel engine. This change was made because of the trouble caused by the power wires connecting the dredge to the shore. Originally this equipment was put on the dredge to ke- it out of the floods which occasionally inundate the plant. The lighting current used on the dredge is now supplied by a small generator connected to the dredge pump motor.

The dredge pump discharges through an 8-in. pipe-line, which is, on the average, 200 to 400 ft. in length and is supported on wooden pontoons. This line formerly discharged over a stationary screen which removed the trash, and the sand and gravel were discharged direct to processing equipment.

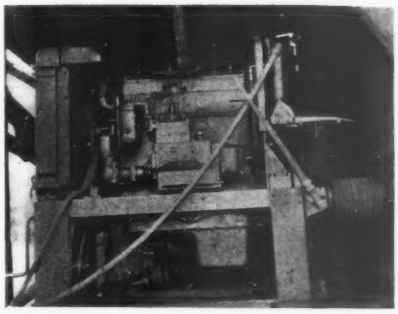
Now the dredge line discharges into a separator, consisting of an old pump

shell with a conical steel base. The trash, consisting of leaves, twigs, bark, etc., overflows and the sand and gravel are discharged on a stationary screen with ¼-in. wire cloth. This removes the sand which can be discharged through a launder to the pond and wasted if desired. Otherwise the sand is loaded direct into cars for shipment. This arrangement for wasting the excess sand is necessary because of the fact that the deposit averages only 30 per cent. gravel. Tests show that a higher percentage of gravel will be obtained as operations move farther into the deposit.

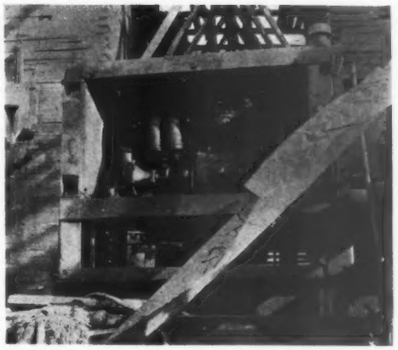
The gravel is discharged through another chute into a clear, worked-out section of the dredge pond. A 6-in. Georgia pump with SKF bearings, driven by an 80-hp. International Diesel engine, moves the gravel from this underwater stock-pile to the screening plant. Some method of stock-piling is needed because, due to the low gravel content of the deposit, it is necessary to operate the dredge about 20 hr. daily to keep the plant operating at its capacity for from 10 to 12 hr. According to Mr. Gibson, this is a very economical method of rehandling stored material and the pumping gives the gravel a thorough washing.

There has been no change in the plant equipment since it was last described. The pipe-line from the reclaiming pump discharges the gravel and water into another pump-shell separator which removes most of the remaining trash. Together the two separators eliminate over 95 per cent. of this material. The gravel passes to a double-screw washer from which it is discharged on a 3-ft. by 17-ft. Pioneer 2-deck shaker screen. Fresh water is added in the washer and at the screen by means of sprays. The gravel produced is stored in bins having a total capacity of about 120 tons. The bins are of latticed wooden construction and, as they are filled with aggregates from the ground up, the material is well drained before it is loaded into cars for shipment. The present capacity of this plant is about 40 tons per hr.

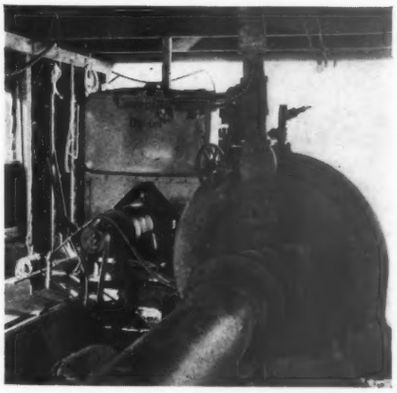
Two steam locomotives, a 75-ton Baldwin and a Porter, are used to haul cars a distance of 3½ mi. on company-owned track to the C. & N. W. Ry. which is a branch of the Atlantic Coast Line. About midway between the plant and the railroad a stock-piled reserve supply of washed and graded gravel is maintained. All the handling of this material to and from cars is done by an Erie steam crane with a ¾-cu. yd. clam-shell bucket.



The Diesel engine which drives a generator for plant power.



The 80-hp. Diesel engine which operates the 6-in. rehandling pump.



The 8-in. dredge pump with the 104-hp. Diesel engine in background.

Germans Make Wide Use of Lime As Admixture

Formerly, *Mineral Trade Notes* (U. S. Bureau of Mines) points out, lime was used commonly in Germany as an admixture to Portland-cement concrete for underwater construction such as sluices, dams, and embankments, but during the past 10 years this use declined greatly. When so used, the proportion of lime to cement was variable. In some instances the lime content was one-half that of cement, but the proportion sometimes is as high as two parts of lime to one of cement. Materials competitive with lime, and that have largely replaced lime during recent years, are trass and Thurament. The former is a natural volcanic rock and the latter is a trade name for a finely ground blast-furnace slag.

Regarding the use of lime in wall plasters and stucco, except for the addition of a very small portion of slaked lime to prepared plaster, lime is not used in the manufacture of wallboard or precast building and partition tile. Magnesia mortar (Sorel cement) is a competitor of lime in stucco. The magnesia mortar is prepared from calcined magnesite mixed with powdered stone, sawdust, and paper materials added as binders. Instead of water, a solution of magnesium chloride is used in mixing. A typical mixture is 1 part of magnesium chloride to 3.5 parts of calcined magnesite. Magnesium-sulphate or magnesium-nitrate solutions may also be used instead of magnesium chloride. Magnesium mortars are used chiefly for plastering tile work, and as flooring materials. As this type of mortar adheres to wood, it is used in wood roofings for protection against the weather. Lime is also used in stucco, but no data are available as to the proportion of total lime so used.

For coating walls and ceilings the following proportions of lime are in common use: For wall plastering, 1 part gypsum, 1 part lime, and 3 parts sand; for ceiling plastering, 2 parts gypsum, 1 part lime, and 3 parts sand.

Other cementitious materials used with lime in plaster and stucco are leukolith and stuccogypsum. The former is made of finely ground anhydrous natural gypsum mixed with 3 parts of dry slaked lime. The latter is a mixture of one part of lime mortar and 3 parts of gypsum putty. Gypsum rather than lime is generally used for finishing-coat plaster.

Wet-Ground Mica Finds Increased Use in Paint

No single development in the mica industry is more important at present than the increasing use of wet-ground mica in paint. Potentialities of this use are enormous. In 1936 ten times as much mica was used in making paint as was used in predepression years, but the quantity was only 1,307 short tons, whereas enthusiasts visualize requirements as high as 100,000 tons annually as a reasonable possibility. In this field, mica supplements as well as replaces asbestine or fibrous talc and is preferably used to the extent of 10 per cent. of the pigment. Specifications call for 90 per cent. ground through 325-mesh and smoothly-rounded edges. If the edges are ragged, as are those of ordinary dry-ground mica, the particles will not lie on one another like fish scales or orient themselves in the plane parallel to the paint-film surface.

The Relative Water Capacities of Portland Cements

By E. W. REED-LEWIS

UNIFORMITY in surface texture is a distinctive feature of any concrete structure that has notably withstood the assault of time. Conversely, concrete that has lamentably lacked durability in service is anything but uniform, either in appearance or in fact. Where concrete must endure, it is therefore reasonable to conclude that uniformity is a characteristic that should be diligently sought.

On a well-conducted job lack of uniformity is seldom due to irregularity in proportioning or in fabrication. The concrete as it leaves the mixer, and as it reaches the forms, is usually homogeneous and reasonably uniform from batch to batch. Under such conditions any lack of uniformity in the hardened concrete must be due to segregation that took place after it was deposited.

Segregation of this type is primarily caused by the presence of an excess of water in the concrete, which is subsequently expelled in the form of excessive "bleeding" or "water gain." The passage of this excess water through the mass not only produces the grosser forms of segregation, such as "honeycomb", "sand pockets", and pockets or layers of "laitance", but also impairs the coherence of the mass in ways less evident to the eye, which may be equally disastrous to the durability of the structure.

It has long been recognized that some Portland cements are more prone to "bleeding" than others, and that, with given aggregates and a definite slump requirement, the only way to overcome this defect is to increase the cement content of the mix. In other words, the actual quantity of cement required to produce a cubic yard of workable, non-segregating concrete, with given aggregates, is determined by the water-retaining properties of the particular cement used.

Under current standard specifications none of the acceptance tests affords any indication whatever of the water-retaining properties of the cement, and since these acceptance tests, quite naturally, are used by the manufacturer as the chief criterion in controlling the quality of his product, it has followed that this important property of cement has been substantially ignored. Yet perhaps no other single property could be more profitably standardized, in the interests of better concrete.

Studies of "Bleeding."—Observations in the cement plant and in the field, coupled with certain laboratory studies, suggest that some modern developments in the manufacture of cement tend to increase "bleeding," and that modern methods of concreting frequently accentuate its evil effects. The net result appears to be that defective concrete from this cause is to-day a serious actuality.

Studies of this problem have been conducted by the writer with some continuity for several years.

These studies indicate that the phenomenon of "bleeding" is largely an active expulsion of water, rather than an entirely passive inability to retain it; that the cement paste subsequently develops a marked tendency to reimbibe some of the water it has expelled; that most Portland cements exhibit these characteristics to a greater or less degree; that they are related to other significant properties of the product and are influenced by several factors that lend themselves to the exercise of control.

While such studies are of interest and of potential value to the manufacturer in suggesting means to control the behavior of his product, the question of prime importance is not "Why does cement 'bleed' ", or "How much does it "bleed' ", or "At what rate does it 'bleed' ", but rather *"How much water will it carry without 'Bleeding'?"*

A *Relative-Water-Capacity Test.*—Seeking the answer to this last question, a tentative procedure has been developed by means of which the relative water capacity of cements can be determined with reasonable precision in the laboratory. The procedure is referred to as "tentative" to indicate that the writer has every hope that better methods of measuring this property will be developed, once its importance is more widely appreciated. In the meantime this tentative procedure serves a useful purpose in permitting studies to be made which afford a general idea of the range over which the property varies in commercial cements, as well as in shedding some light on the phenomenon of "bleeding" as above mentioned. Relative-water-capacity values express the quantity of water, as a percentage by weight, which the cement will carry under the conditions of the test. These percentage values can, of course, be converted to gallons per sack, or any other preferred terms of expression.

In Fig. 1 relative water capacity is shown in relation to fineness for a number of different commercial Portland cements. It will be noted that relative-water-capacity values cover a range from 33.5 to 61.1 per cent. In U. S. gallons per 94-lb. sack this corresponds to a range from 3.79 to 6.90 gal.

It will be obvious that these relative-water-capacity values must not be interpreted as being the maximum quantities of mixing water that can be used in field concrete without encountering objectionable "bleeding". The aggregate also has a "water capacity", which supplements that of the cement. The actual water capacity of the *concrete* will, therefore, be significantly influenced by the nature and grading of the aggregate, the selected ratio of aggregate to cement, and other factors related to the conditions under which the concrete is fabricated and placed.

Interpretation of R.W.C. Values.—It seems entirely warranted, however, to interpret these relative-water-capacity values as meaning that *under any equal field conditions* a cement with a relative-water-capacity equivalent to 5 gal. per sack, for example, will carry 1 gal. per sack *more* mixing water, without "bleeding", than will a cement with a relative-water-capacity equivalent to 4 gal. per sack.

To illustrate the truth of this statement, a simple segregation test has been devised, some results with which are here shown photographically. In this segregation test a graded silica sand was used in conjunction with a fixed ratio of silica pebbles. In varying the mix the ratio of cement-water paste to aggregate, by absolute volume, was kept constant, the only variable being the ratio of cement to water. Following a standardized mixing procedure, an ordinary 1 qt. Mason jar was filled with the concrete, struck off level, the rim wiped clean and the cap screwed on tightly; the jar was then immediately turned upside down and left undisturbed. After an interval of 10 min. the jar was gently turned right side up. This reversal of the jar at 10-min. intervals was repeated a fixed number of times. Following the last reversal it was left undisturbed until the concrete had hardened, when the jar was broken away

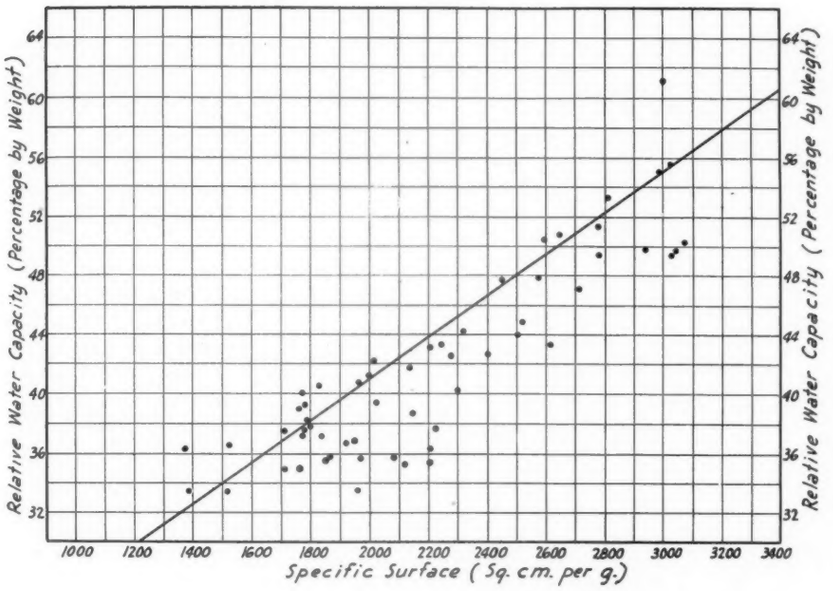


Fig. 1—Relative water capacity in relation to specific surface, illustrating that factors other than fineness influence water capacity.

and the specimen preserved to be photographed.

Under these conditions if a given mix 'bleeds' to any significant degree, the excess water will flow from end to end when the jar is reversed, leaving an unmistakable trail of segregation in its wake, which can be clearly seen through the glass jar as it occurs, just as it is clearly observable in the accompanying photograph. If the mix does not 'bleed', the concrete in the jar remains homogeneous.

With the particular combination of aggregates used and a constant ratio of cement-water paste to aggregate of 1:2.48 by absolute volume it was found that any given cement would carry, without 'bleeding', 1.1 gal. per sack more water than the quantity indicated by its relative-water-capacity value, and that this relation held true over the entire range of relative-water-capacity values.

Under these arbitrarily-selected conditions with respect to aggregates and proportions an average Portland cement with a relative-water-capacity of 37 per cent. would carry 5.3 gals. of water per sack in a mix containing 6½ sacks per cu.yd. Under similar conditions an average high-early-strength Portland cement with a relative-water-capacity of 50 per cent. would carry 6.8 gals. per sack in a mix containing 5½ sacks per cu.yd.

With other aggregates or other proportions the water capacities of the concretes would vary appreciably above or below these values, but the relative water capacity of the cement would remain the major factor in determing the water capacity of the concrete.

Referring again to Fig. 1, it will be noted that while there is a logical and definite trend toward an increase in relative water capacity with increased fineness, the general direction of which is shown, there are wide deviations from this trend, indicating quite conclusively that factors other than fineness substantially influence the water capacity of the product. For example, there are shown cements of essentially equal relative-water-capacity that vary in fineness by as much as 800 sq. cm. per g., and cements of essentially equal fineness that vary in relative-water-capacity by as much as 11.5 per cent., or 1.3 gal. per sack.

Further Study Necessary.—In order to establish the relation between relative-water-capacity and other significant properties of cements much further study is necessary. In most cases there appear to be obvious economic advantages associated with the use of a cement of high relative-water-capacity. It can not be concluded, however, that such a characteristic is necessarily desirable from every point of view, for all types of use. It may well be, for instance, that when sand molds are employed in the manufacture of cast stone, the use of a cement with a comparatively low relative-water-capacity would tend to prevent the subsequent development of shrinkage cracks; whereas with metal molds the reverse might prove to be true.

The ability to measure this property should lead to a better knowledge of its true significance, permitting the consumer to determine what relative-water-capacity best suits his specific purpose. The use of the relative-water-capacity test by the producer will enable him to choose appropriate and economic means to give the consumer what he requires.

Finally, when it becomes generally recognized that this property of cement can be reliably measured, the occurrence of segregation due to the use of excess water will be less frequent; for it should become conventional good practice to consider relative-water-capacity as an important factor in designing concrete mixes, and there will no longer be a conveniently unmeasurable property of the cement on which to blame the results of careless job control.

Details of Relative-Water-Capacity Test.— In determining the relative-water-capacity of cement standard Ottawa sand is used as the aggregate, because of its uniformity and general availability. Seeking a definite degree of water retention, hereinafter specified, trial batches are made up in which the ratio of cement to water is varied, while maintaining at a constant value of 1.0 the ratio of the absolute volume of the sand to the absolute volume of the cement-water paste.

With a standard batch quantity of 1,000 g. of the sand, having an absolute

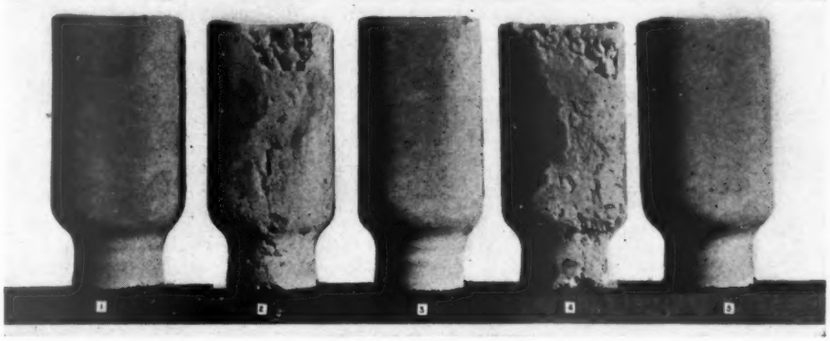


Fig. 2—Mason-Jar Segregation Test with Pebble Concrete.

Specimen	Cement	R.W.C.	Concrete Mix	
			Gal. per Sack	Sacks per Cu. Yd.
1	A	61.1	8	5.0
2	B	55.6	8	5.0
3	B	55.6	7¼	5.4
4	C	43.3	7¼	5.4
5	C	43.3	6	6.0

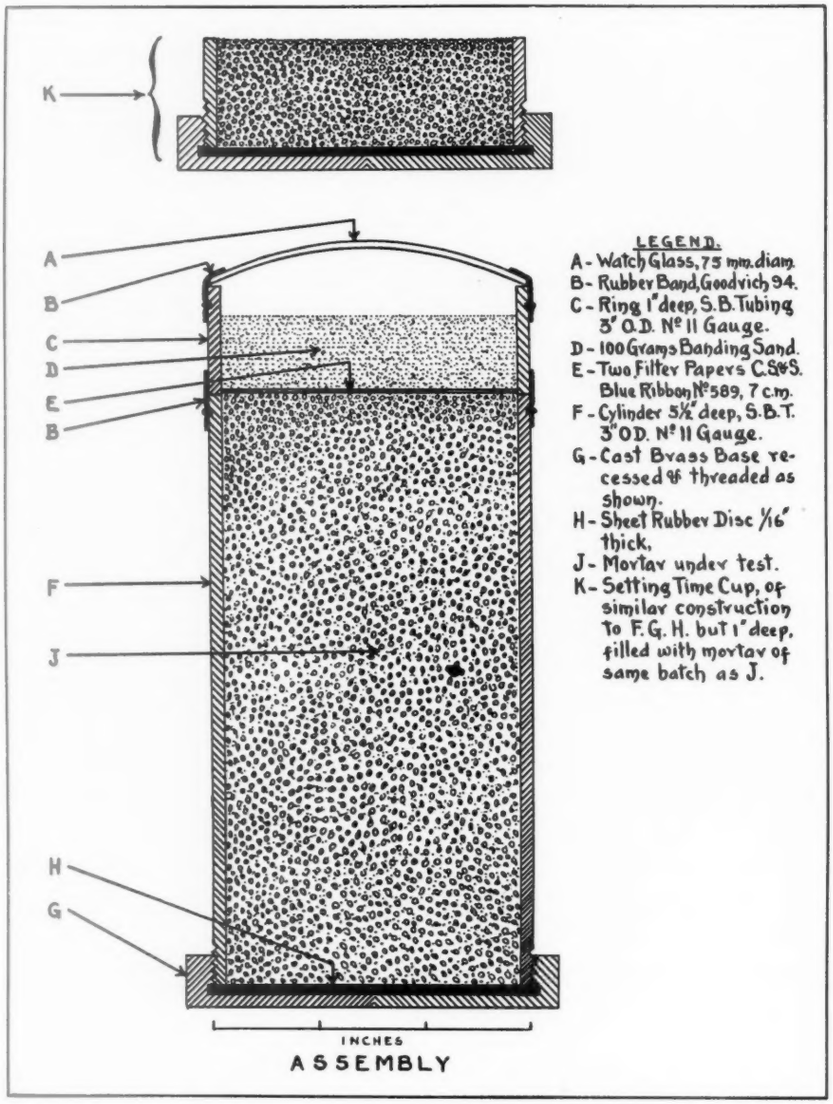

K
A
B
C
D
E
B
F
J
H
G
LEGEND.
A - Watch Glass, 75 mm. diam.
B - Rubber Band, Goodrich 94.
C - Ring 1" deep, S.B. Tubing 3" O.D. N° 11 Gauge.
D - 100 Grams Banding Sand.
E - Two Filter Papers C.S.&S. Blue Ribbon N°589, 7 cm.
F - Cylinder 5½" deep, S.B.T. 3" O.D. N° 11 Gauge.
G - Cast Brass Base recessed & threaded as shown.
H - Sheet Rubber Disc 1/16" thick.
J - Mortar under test.
K - Setting Time Cup, of similar construction to F.G.H. but 1" deep, filled with mortar of same batch as J.
INCHES
ASSEMBLY

Fig. 3—Apparatus for determining relative water capacity and mortar-setting time tests.

volume of 379 cc., and assuming a uniform specific gravity for Portland cement of 3.15, the batch quantity of water for any selected batch quantity of cement is determined by the formula:

$$\text{Cc. of water} = 379 - \frac{\text{grams of cement}}{3.15}$$

Mixing.

(1) Cement and water are mixed for 1 min. in a granite-ware bowl with the gloved hand.

(2) The sand is added and mixing continued for 2 min.

(3) The bowl is covered and allowed to stand undisturbed for 5 min.

(4) The mortar is remixed for 1 min. and the molds immediately filled.

The purpose of allowing the mortar to stand for 5 min., followed by a remixing operation, is to break any early stiffening tendency that the cement may happen to possess. If unbroken, such early stiffening would effectively prevent the rise of surface water and result in a false value for the relative-water-capacity of the cement.

Molding.

Referring to the assembly diagram herewith (Fig. 3), the upper 1-in. ring, *C*, being removed from the tall cylinder, *F*, this cylinder is filled with the mortar in a continuous operation by stirring it through an inverted "slump cone" with a glass rod. The excess mortar is struck off with a sawing motion of a straight-edged trowel; the rim of the cylinder is wiped off with a sheet of Kleenex; the 1-in. ring, *C*, is placed in position and the joint sealed by rolling up the rubber band, *B*; the two filter papers, *E*, are placed on the top of the mortar and the carefully-weighed 100 g. of "banding sand," *D*, is poured on the filter papers. The assembly is then sealed with the watch glass, *A*, held in position by the second rubber band. The setting-time cup, *K*, is then filled with mortar from the same batch, and both molds are placed in the moist closet to remain undisturbed until the mortar has set.

Determination of Mortar Set.

When the mortar in the cup, *K*, has hardened to such a degree that the ¼-lb. Gillmore needle fails to penetrate, the mortar is considered to have set. This end-point is the definite distinction between a "penetration" and a "surface impression." In making this distinction the period of doubt seldom exceeds 15 min.

Determination of R.W.C.

The mortar in the cup, *K*, having reached its set, the quantity of surface water that has been expelled by the mortar in the tall cylinder, *F*, and absorbed by the banding sand, *D*, is determined by inverting the assembly and separating the cylinder, *F*, from the ring, *C*. The latter now contains the banding sand with its absorbed water and one filter paper, which are transferred to a balance and weighed. The increase in weight of the banding sand indicates the quantity of water that has been expelled by the mortar.

The definite degree of water retention by the mortar which is sought, is that resulting in an increase in weight of the banding sand of precisely 8 g. This is an arbitrary but judiciously-selected value that can usually be attained without having to test more than from 2 to 4 trial batches.

In this latter connection, if one trial batch yields a value exceeding 8 g. but less than 9 g., and another trial batch yields a value less than 8 g. but more than 7 g., sufficient accuracy for all practical purposes will be attained by interpolating between these obtained values to determine the batch quantity of cement that should yield the desired value of 8 g.

Having determined the required batch quantity of cement for an 8-g. increase in weight of the banding sand and computed the corresponding batch quantity of water by the formula previously given, then the water expressed as a percentage of the cement by weight is the relative-water-capacity value of the cement.

Example:

Batch Quantities	Standard Sand	Cement	Water	Increase in Weight of Banding Sand
1st Trial	1,000 g.	460 g.	233.0 cc.	8.8 g.
2nd Trial	1,000 g.	470 g.	229.8 cc.	7.2 g.
By Interpolation	1,000 g.	465 g.	231.4 cc.	8.0 g.

$$\text{Relative-Water-Capacity} = \frac{231.4 \times 100}{465} = 49.8 \text{ per cent.}$$

3-MAN SAND PLANT PRODUCES 200 T. P. H.

By W. E. TRAUFFER

The new plant of the Henry J. Kaiser Co. viewed from the far side of the pit.

THE Henry J. Kaiser Co., of Oakland, Cal., formerly the Kaiser Paving Co., very evidently believes that, in order to make money, it is first necessary to spend some. This was the case with the Radum, Cal., sand-and-gravel plant operated by this company. When built in 1930, this plant, with a capacity of 400 tons, per. hr., was one of the largest commercial operations in this industry and no expense was spared on its construction and equipment. Many methods new to this industry were developed. This plant has since been enlarged and now has a capacity of 1,200 tons per hr.

On June 15, 1937 the company put into operation near Olympia, Cal., a new sand plant which is as outstanding a development as the Radum plant, but on a smaller scale. This new plant has an hourly capacity of 200 tons of washed and graded plaster sand with a force of only three men, including the superintendent. One man operates the scraper hoist, another takes care of the loading operations and the superintendent controls the plant operations. In equipment and design this plant ranks with the best and many original methods of operation are involved. Concrete and steel were used exclusively in its construction.

This plant and its deposit are located in the San Lorenzo Valley, 12 mi. north of Santa Cruz and only a few miles from the celebrated Big Trees. It is on a spur track of the Southern Pacific Rwy., over which most of the product is shipped to the San Francisco Bay area, a distance of about 65 mi. through hilly country. The sand found in the vicinity of Olympia is white and sharp and has a gradation of fine and coarse particles which makes it ideal for plastering.

This company controls a tract of 167 acres on which the deposit extends to varying depths up to 180 ft. Ledges of fine and coarse sand make it possible to predetermine the gradation of the finished product in the pit to any desired specification. The deposit was covered with trees and overburden ranging up to 6 ft. in depth. After the trees were removed a Le Tourneau Carryall scraper drawn by a Caterpillar tractor was used to remove the overburden.

An average analysis of the deposit shows: 92 per cent. minus 4-mesh; 75 per cent. minus 10-mesh; 50 per cent. minus 30-mesh; 30 per cent. minus 40-mesh; 5 per cent. minus 80-mesh; 1 per cent. minus 200-mesh. Rock from ¼ in. to ¾ in. in size averages about 6 per cent. of the total. Except for a small amount of surface vegetation, etc., there is no deleterious matter and little silt.

A 4-cu. yd. drag-scraper, operated by a 2-drum Washington hoist, is used to excavate material from the deposit. At present this scraper is working with a maximum haul of 325 ft. and needs to be operated only about 60 per cent. of the time to keep the plant supplied. The contents of the scraper are discharged into

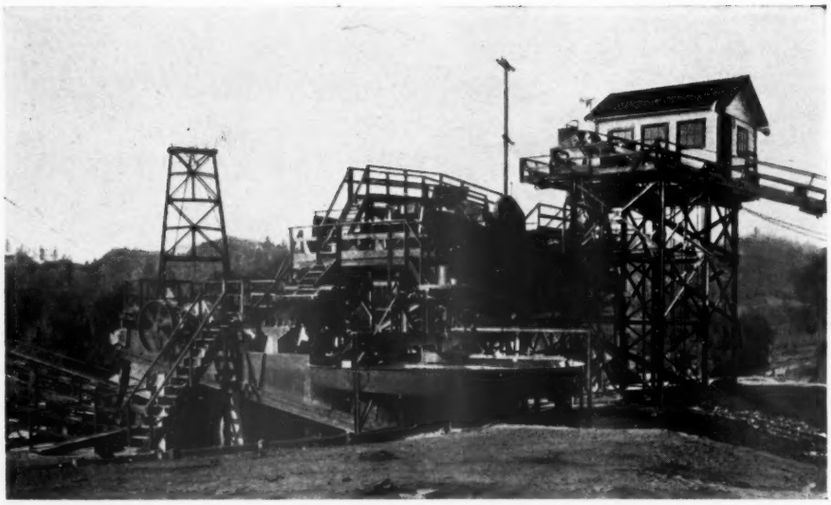
Another view of this plant showing the three boom stock-piling conveyors and the stock-piling facilities.

a 20-ton steel hopper. A slide gate controls the rate of discharge from this hopper and an electric vibrator insures a steady feed.

A 30-in. belt-conveyor on 125-ft. centers carries the material to the top

The conveyor towers, showing the circular track and one of the drainage sluices.

of the plant where it is discharged on a 3-ft. by 6-ft. Buffalo Niagara single-deck vibrating screen fitted with 1-in. wire cloth. This screen is equipped with sprays. Oversize material from this screen—clods, roots, etc.,—is discharged into a waste pile. The material passing through this screen drops through a 4-way split chute into four Bodinson 30-in. by 12-ft. trommels. Each of these screens has three 4-ft. sections, one of 20-mesh wire cloth, one of 10-mesh and one of 6-mesh. High-pressure sprays



A close-up view of the plant with the bowl and rake classifiers in the foreground. The belt-conveyor from the pit is at the right.

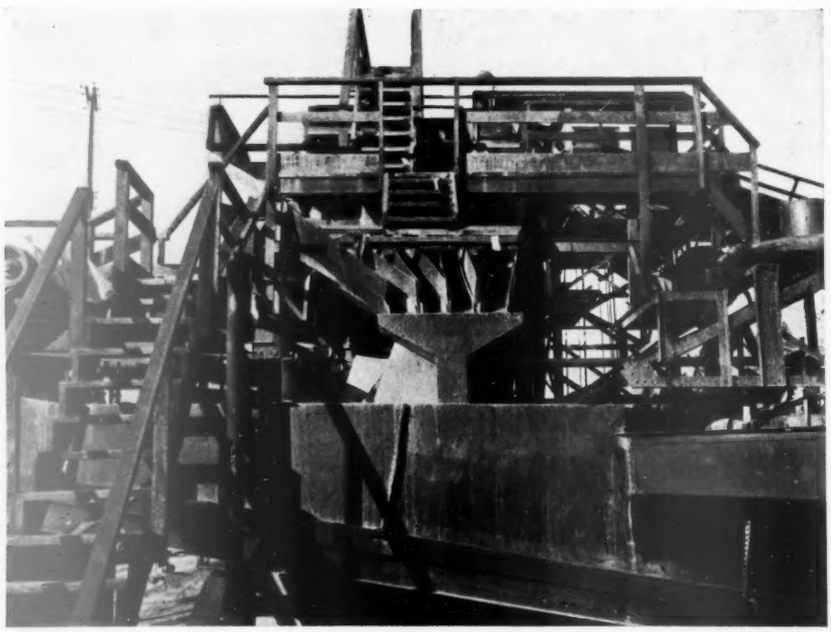
beating down on the tops of these screens drive out any particles sticking in the openings. The bottoms of these screens are from 2 in. to 6 in. under water as it has been found that the sand can be more effectively washed and screened in this manner.

The 6-mesh to 1-in. material retained on these screens is discharged into a 15-ton steel hopper, from which it is hauled in trucks. Some of this material is sold locally as concrete rock, but most of it goes to waste.

The three sizes of sand passing through these trommels are discharged into a Bodinson rake classifier with four reciprocating rakes, each 3 ft. wide and 34 ft. long. One size of sand goes into each of three rakes, while the fourth rake is used for carry-overs from the finer sizes. This system is used for the production of No. 1 and No. 2 plaster sands. When concrete sand is to be produced, ¼-in. cloth is used on the last sections of the screens.

Each of the four rakes discharges its product through an individual chute with a 4-way gate. These gates make it possible to feed almost any desired gradation of sand into any of four hoppers. Each of these hoppers

Looking down on the four revolving screens with their high-pressure sprays.

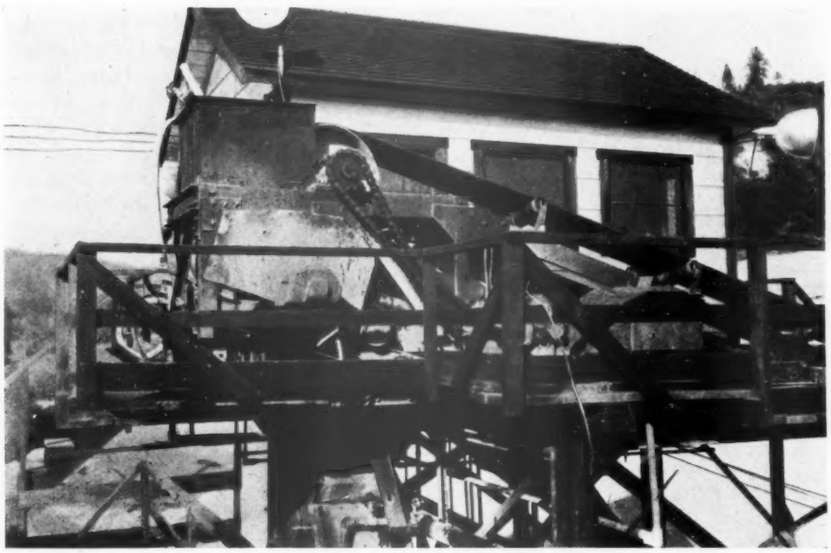


The 4-way chutes which feed various gradations of sand to the four rakes of the bowl classifier.

feeds one of the four rakes of a Dorr bowl-and-rake classifier. Each of these rakes is 4 ft. wide and 32 ft. long, and the bowl is 20 ft. in diameter. Usually two of these rakes are used for No. 2 plaster sand and one for No. 1 plaster sand. The overflow from the Bodinson classifier and the overflow from these three rakes of the Dorr classifier are discharged into the bowl of the Dorr classifier. Settled fines from the bowl are discharged into the fourth rake for the production of asphalt sand. As considerable leeway in the gradation of the asphalt sand is permissible, this makes possible

a closer control of the other grades. When concrete sand is being produced, two of the Dorr rakes are used for this material and one for No. 1 plaster sand. The fourth rake, producing asphalt sand, also serves as a by-pass in this case for a better control of the other two grades.

Three inclined stock-piling conveyors are used to store the various grades of sand produced. Each of these conveyors is 18 in. wide and 75 ft. long and is suspended from a steel tower which is mounted on two steel wheels running on a single circular track. The feed or tail end of each conveyor and the bottom of each tower is connected to a steel pin or shaft at the center of the arc formed by the track. The towers are moved along this track by means of hand winches and the same method is used to raise and lower the conveyor booms which are hinged at the towers. Together these conveyors cover an arc of 125 deg.



The conveyor from the pit and the vibrating screen and the four-way chute to the trommels.

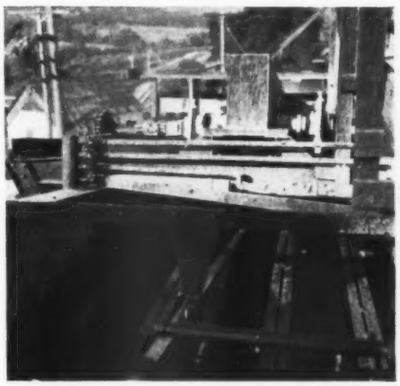
These three conveyors can serve any reasonable number of stock-piles, but at the time the writer visited this plant only four sizes of material were being stored: concrete sand, No. 1 plaster sand, No. 2 plaster sand, and asphalt sand. Each of the two outer piles had a capacity of 20 car-loads and each of the two inner piles held 12 car-loads. Special movable wooden partitions are used to separate these piles. These partitions have flaring triangular bases which hold them upright against unequal pressures from the sides.

Under the stock-piles is a concrete floor, which makes it possible to recover all the stored material without any danger of contamination. This concrete extends under the stock-piling conveyors and any water dripping from their collecting troughs flows into a trough in the floor which serves a waste flume. Water draining out of the stock-piled materials is disposed of in a similar manner. A concrete retaining wall prevents the overflow of stock-piled materials on the spur track serving this plant. Cars are loaded by an Industrial Brownhoist No. 5 locomotive crane which also does all the switching and "spotting" of cars. This crane is powered by an Atlas Imperial Diesel engine and has a 1½-cu. yd. Owen clam-shell bucket. This crane also serves two 15-ton bins from which local truck shipments are made.

All the overflow from the Dorr classifier and from the drainage system goes into a concrete sump, from which the water and suspended solids are pumped into a flume feeding a 50-ft.-diameter by 10-ft. Dorr steel-bowl settling tank. The water overflowing this tank is returned to the plant for re-use by a United Iron Works 1,000-gal. per min. pump and a 500-gal. per min. pump. Another 500-gal. per min. pump is kept in reserve. The fine sand settled out in the tank is drained off into a sump, from which it is transferred to stock-piles at intervals by the locomotive crane.

This plant was designed by the engineering and operating staff of the Henry J. Kaiser Co. from its experience in operating the company's plant at Radum and other sand-and-gravel plants supplying the huge construction projects in which it is also interested. Except for the scraper hoist, all the plant equipment is controlled from a push-button station in a building at the top of the plant. This building also serves as the plant office and has a teletype machine connected to the company's main office in Oakland.

With a few exceptions all the electric motors in this plant were supplied by the General Electric Co. The Link-Belt Co. furnished all the belt-conveyors, which use Pioneer conveyor belting. All the chutes are lined with American Rubber Co. rubber chute lining. A Lincoln Shield Arc arc-welder was used in the construction of this plant and is kept on hand for plant maintenance.



Looking down into the rake classifier.

The scraper hoist is driven by a 100-hp. motor and the main conveyor by a 30-hp. motor through a chain drive. The Bodinson rake classifier is gear-driven by a 20-hp. motor and the revolving screens are chain-driven from the same motor. The vibrating screen is driven by a 3-hp. motor through Gates V-belts. The Dorr rakes are driven by a 20-hp. motor through Gates V-belts and the Dorr bowl classifier is driven through a worm gear by a 7½-hp. motor. Each of the three stock-piling conveyors is driven at its tail end by a 7½-hp. motor through a Pacific gear-reducer and chain.

The 50-ft. settling tank which classifies wash water for re-use in the plant.

HARD-FACING CUTS REPLACEMENT COSTS

A PROMINENT midwestern cement company has made considerable savings by the application of a hard, wear-resistant alloy to grinder-ring wearing surfaces. Translated into the cost of a ring per barrel of cement ground, the cost was by this method actually reduced from 0.022 c. to 0.0095 c. At the same time the output was increased by 17 per cent. The following table shows the comparative ring costs and production records over a period of time equal to the life of the hard-surfaced rings.

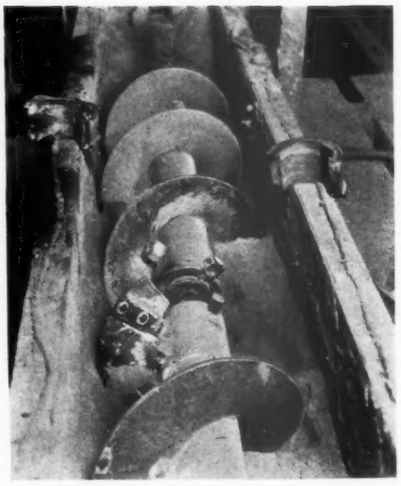
	Steel Rings	Hard-Surfaced Ring
Life per ring.....*hr.*	400	7,500
Cost per ring.....	$135.00	$850.00
Cost of rebuilding.....	.....	$200.00
Total ring cost (7,500 hr.)	$2,531.25	$1,050.00
Time shutdown for replacements and repairs .....*hr.*	427	30
Average output..... .....*bbl. per hr.*	125	147
Cost of rings per bbl.....	0.022c.	0.0095c.
Increase in output..... .....*per cent.*	.....	17

At a Michigan cement mill screw-conveyor gudgeons were a constant source of trouble. The two $1\frac{15}{16}$-in.-diameter shafts wore down from ½ to ¾ in. within but three months. New gudgeons for the machine cost approximately $1, and almost an hour is required to replace them. A wear-resistant hard-facing alloy was applied to one of the gudgeons as an experiment. Results showed that after 22 months the shafts had worn but $\frac{1}{32}$ in. in diameter. Needless to say, this plant now hard-faces all of its gudgeons.

Results of tests such as these have definitely proved the worth of the hard-facing process wherever wear occurs in the plant. Standard welding equipment and a good welding operator are all that is required to duplicate these savings in other plants.

Hard-facing consists essentially in applying, by one of the familiar welding processes, a wear-resistant alloy to surfaces requiring high abrasion resistance. When a surface is subjected to constant friction, an extremely thin outer contact layer may be working at quite a high temperature. A number of tests have been made to demonstrate this fact. One of these, in which the contact of a wire held against a rotating disk was employed as a thermal junction, the temperatures recorded in this way, even under slight pressure, reached 1,500 deg. F. Thus, although little evidence of such a temperature is given to the eye, it does exist, and it plays an important part in determining the rate of wear of the surfaces in contact.

Plows hard-faced with the oxy-acetylene blowpipe give four times as much service.



Where steel shafts wore over ½ in. in three months, hard-faced shafts now wear but 1/32 in. in almost two years.

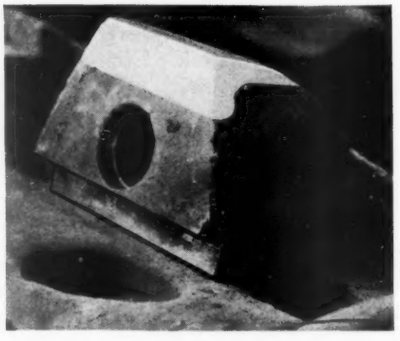
When most metals are heated to temperatures of this magnitude, they lose much of their hardness. Any softening will result in a more rapid removal of metal between the surfaces working on each other. Thus the most wear-resistant metal is that which is harder at high temperatures.

Available as welding rods, such an alloy is applied to most ordinary steels by the usual welding methods. Either the oxy-acetylene or the electric-arc process can be used, but the oxy-acetylene method allows a more closely-controlled and purer deposit. A few simple precautions enhance the properties of the hard-facing deposit and insure maximum satisfaction. The steel surface should be thoroughly cleaned, and brought to a "sweating" heat—just below the melting point—with the oxy-acetylene flame. The alloy is then allowed to flow on the base metal, spreading evenly and readily under the proper conditions. Melting the base metal is not advisable, for any dilution of the non-ferrous alloy by iron tends to lower its wear-resistant properties. Practically the same technique is used in applying hard-facing material to cast iron, the only differences being due to cast iron's lower melting point and the crust which must be broken up. Slight puddling may be necessary, but after a thin layer of non-ferrous deposit has been made, it is best to go over the section again to build it up to the final dimensions. If this method is followed, the outer layer of alloy will contain no iron and will retain a maximum of wear resistance.

In many cases where parts are large and difficult to preheat the electric-arc method is used for applying hard-surfacing material. However, in using this method it should be borne in mind that some dilution of the wear-resistant alloy will occur, and therefore penetration should be kept to the minimum by using reversed polarity and drawing a long arc. The welded surface obtained is usually not as perfect as that resulting from the application by the oxy-acetylene process, but this process is quite satisfactory for many jobs.

Rebuilding old parts, and even hard-facing new parts before they are put in service, has become an important phase in the activities of the maintenance departments of a number of cement mills. One of the largest savings in a plant can be made by hard-surfacing screw-conveyor flights. The experience of a Michigan cement plant showed that the average life of an ordinary steel screw was five weeks, whereas hard-faced screws last 25 weeks, or five times as long. In one day this plant reclaimed three 6-in. conveyor screws. The total cost of labor and material was $57.45. Since the cost of three new conveyor screws would have been approximately $570, the hard-facing process saved this plant about $512 on this one job alone.

(Continued on page 49)



The life of this roll-crusher tooth was increased four times by hard-facing.

New Wage-and-Hour Law Will Become Operative in October

THE new wage-and-hour law will become operative on or about October 22, 1938. All employees covered by the minimum-wage provisions will have to be paid at least 25 c. an hour during the first year, 30 c. an hour for the next 6 years, and 40 c. an hour thereafter. This is subject to the exception that the Administrator may, upon the recommendation of the industry committees to be appointed by him, either expedite the attainment of the 40-c. minimum or defer its attainment so long as not less than 30 c. an hour is paid, after the expiration of one year.

No employee subject to its provisions may be employed for longer than 44 hours a week during the first year, 42 hours a week during the second year, and 40 hours a week thereafter. There is no daily limitation and employees may be worked in excess of the prescribed maximum if they receive compensation for such overtime at the rate of at least one and one-half times their regular rates of pay. No authority is granted to the Administrator, as in the case of minimum-wage provisions, to vary the length of the maximum workweek.

Exceptions to the maximum-hour provisions are provided for in the law under some circumstances. These exceptions apply to seasonal industries and to employers operating under certain types of collective-bargaining agreements, which would permit employment in excess of the maximum hours without the payment of overtime. Before such collective-bargaining agreements can be recognized by the Administrator, it must be shown (1) that they were executed with representatives of employees certified as *bona fide* by the National Labor Relations Board, and provide that no employee shall be employed more than 1000 hours during any period of 26 consecutive weeks; (2) or on an annual basis pursuant to an employer-employee agreement, where such agreement was made through collective bargaining by representatives of employees certified as *bona fide* by the National Labor Relations Board, which provides that the employee shall not be employed more than 2,000 hours during any period of 52 consecutive weeks; (3) or for a period or periods of not more than 14 workweeks in the aggregate in any calendar year in an industry found by the Administrator to be of a seasonal nature.

Superimposed upon these three exceptions is the legal requirement that under no circumstances shall employees be worked in excess of 12 hours in any day or in excess of 56 hours in any week, as the case may be, unless he receives a rate of one and one-half times the regular rate at which he is employed. A limited group of industries is specifically exempted, but the mineral industries are not included therein.

Subject to definition and delimitation by the Administrator, the law will not apply to persons employed in executive, administrative, professional, or local retailing capacities, or in the capacity of outside salesmen. Employees of retail or service establishments are also exempted where the greater part of the business of such establishments is in intrastate commerce.

In interpreting the scope of the law, V. P. Ahearn, executive secretary of the National Sand & Gravel Assn. has this to say:

"The act stipulates that all employees engaged in commerce or in the production of goods for commerce are covered by the law. The term 'employer' is defined to include any person acting directly or indirectly in the interest of an employer in relation to an employee. The term 'employee' includes any individual employed by an employer, and the term 'employ' includes to suffer or permit to work.

"The term 'production' is defined to mean produced, manufactured, mined, handled, or in any other manner worked on in any state. The term 'commerce' is defined to include trade, commerce, transportation, transmission, or communication among the several states or from any state to any place outside thereof.

"The act applies to every employer, regardless of the number of employees in his employ, if one or more of his employees is either engaged in commerce or in the production of goods for commerce. Therefore, it would appear that all employees of a given employer are subject to the law if the nature of their work brings them within these definitions. Considerable clarification, however, through the medium of administrative regulations, is needed before any definite understanding of these provisions can be obtained.

"The question immediately arises, under these circumstances, as to how the Administrator will proceed in the case of an industry like our own. Two courses of possible action suggest themselves: the Administrator may hold that a given industry is 'engaged in commerce or in the production of goods for commerce' and that therefore every member of that industry is subject to the law; or each employer's business may be examined and a determination reached as to whether the law is operative.

"At the moment I am inclined to believe that the Administrator may follow a policy which involves a combination of these two alternatives, and it would seem that the law would permit him to do this in view of the generality of its phraseology. This would be to hold that each employer must determine for himself whether he has employees "engaged in commerce or in the production of goods for commerce," and having so determined, apply the law if he considers it to be effective or refrain from applying the law if he considers his employees outside its provisions. Thus the whole burden of proof would rest upon the employer, and he would run the risk, if he should determine for himself that he had no employees subject to the act, of being later required to pay liquidated damages to his employees and to suffer the other punishments of the law if the Administrator should determine upon investigation that the employer in question had employees who were actually subject to the law.

"The association realizes that this is the fundamental question which all members want answered as quickly as possible. We shall keep in close touch with the situation and keep members constantly informed on this basic phase of the statute. In the meantime, all member companies are invited to correspond with us on this subject. It can not be too strongly emphasized, let us repeat, that throughout the statute the burden of proof is placed squarely upon the employer. That is something which must not be overlooked."

As soon as practicable, the Administrator is required to appoint an industry committee for each industry engaged in commerce or in the production of goods for commerce. The committee shall include equal representation of the public, the employers, and the employees. The Administrator is required to give due regard, in appointing the committees, to the geographical regions in which the industry operates. Two-thirds of the committee are to constitute a quorum and decisions are to be made by majority vote.

The industry committee will recommend to the Administrator the minimum rate or rates of wages to be paid to employees subject to the law, with

(Continued on page 57)

Builds New Sand-and-Gravel Plant to Meet T.V.A. Specifications

THE Montgomery Gravel Co. of Montgomery, Ala., one of the larger producers of sand and gravel in the south, in the fall of 1937 was confronted with the problem of producing sand and gravel in large quantities to a very strict specification for the United States Lock and Dam on the Warrior River at Tuscaloosa, Ala. This dam, which is being built under the supervision of engineers of the U. S. War Dept., is for navigation.

A test made in November, 1935, by a T.V.A. inspector on a shipment of 17,000 tons of sand for the Joe Wheeler dam made it clearly evident that the old plant operated by the company at Montgomery would be unable to meet these specifications in the quantities required, due mainly to an excess of 16- to 50-mesh material in its product. For this reason the new plant was built and its design was based largely on the many years of operating experience of C. B. ("Barney") Ireland, president of the company, and T. F. Wallace, general manager.

The contract for aggregates for this dam calls for a minimum of 200,000 tons of gravel and 100,000 tons of concrete sand. The new plant is producing in each 10-hr. day 20 carloads of gravel in two sizes (¾-in. to 1½-in. and ¾-in. to 4-mesh) and 15 carloads or about 800 tons, of Federal specification concrete sand. About five carloads of brick or engine sand are also produced.

The success with which this problem has been met is evident from the results of a test made in February, 1938, by P. T. L. on about 17,000 tons of sand shipped to the Tuscaloosa Dam.

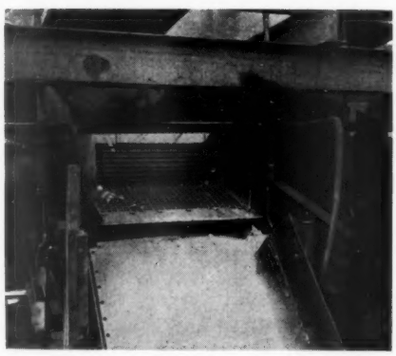
The dredge which supplies the sand plants. Note the hydraulicking jet being used.

The Federal sand specification for this job and the results of the two tests mentioned are as shown below.

It can be seen from this table that the percentage between the 30-mesh and 16-mesh screens has been reduced over 53 per cent. and that the percentage between the 50-mesh and the 30-mesh screens has been reduced a little over 13 per cent. Wasting this large surplus of 50-mesh to 16-mesh caused an increase in the plus 16-mesh as well as an increase in the minus 50-mesh. A further increase in the percentage of minus 50-mesh was effected by the more efficient settling equipment now being used.

This deposit was first opened by the Montgomery Gravel Co. in 1926 and the original dredge pond has grown into a lake over an area about 5,000 ft. long and 650 ft. wide. Seven different plants have been built since that time and five of these have been worn out, abandoned, or moved. These plants have been operated singly and sometimes two at a time to supply the demand. One by one the older plants were moved or dismantled and replaced by more modern and efficient plants and now only the two new plants described in this article are operated. It

Mesh	Federal Sand-Specification Limit	Product of Old Plant	Product of New Plant
	Percentage Passing by Weight	Percentage Passing by Weight (Avg. November, 1935)	Percentage Passing by Weight (Avg. February, 1938)
100	1.5 to 7.0	0.5	2.85
50	10.0 to 25.0	5.2	15.93
30		43.6	49.28
16	35.0 to 75.0	85.7	68.95
8		96.9	85.50
4	95.0 to 100.0	100.0	98.48
		Percentage Between Screens	Percentage Between Screens
Minus 100		0.5	2.85
100 to 50		4.7	13.08
50 to 30		38.4	33.35
30 to 16		42.1	19.67
16 to 8		11.2	16.55
8 to 4		3.1	12.98
Plus 4		0.0	1.52
		100.0	100.0



One of the two vibrating screens which produce the two sizes of gravel.

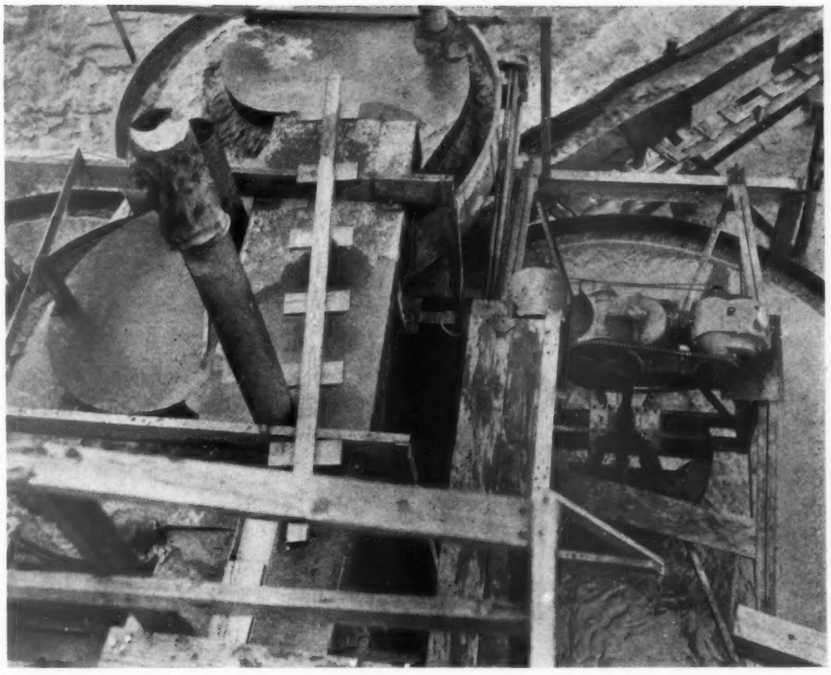
has been the policy to change plant locations just as fast as the lack of dredging efficiency demanded.

The deposit averages about 40 ft. in depth, 20 ft. of which is below water level, and has approximately 10 ft. of fine sand overburden which is not removed. About 40 per cent. of the material being pumped is gravel.

The dredge which supplies the larger of the two new plants is not new and few changes have been made in it since it was described in the June 17, 1931, issue of PIT AND QUARRY. At that time it supplied the then newest plant of the company which had just been completed and of which only the skeleton now remains.

On the dredge an Allis-Chalmers centrifugal pump supplies water at high pressure to a nozzle which washes down the overburden with the bank so that there is a constant and well-balanced supply of material at the intake nozzle. This assures a comparatively steady and evenly-graded feed to the plant, which is an important factor in the accurate classification of the material at the plant. The 12-in. Amsco Type H pump is driven by a 400-hp. motor and is pumping the material about 800 ft. to the plant against a static head of about 40 ft.

The material is discharged from the pipe-line into a rubber- and steel-lined wooden box from which it passes over two pairs of 3-ft. by 6-ft. inclined stationary screens. The least amount of gravity-screen area is used in order to keep the pump head down and the pump capacity up. Tyler 4-mesh carbon-steel wire cloth with $\frac{3}{16}$-in. square opening is used. The oversize from these screens is discharged on two 3-ft. by 8-ft. Tyler Niagara 3-deck vibrating screens, which are equipped with $\frac{7}{8}$-in., $\frac{1}{2}$-in., and $\frac{1}{4}$-in. Harristeel wire cloth made by the Harristeel Products Co. and are driven by 5-hp. Allis-Chalmers motors. The $1\frac{1}{2}$-in. gravel retained on the top deck and the $\frac{3}{4}$-in. gravel retained on the middle deck go to bin storage. The pea gravel retained on the bottom deck also goes to storage and is sold for concrete pipe, roofing, etc. Three steel bins of 50-ton capacity each are used to store these materials.



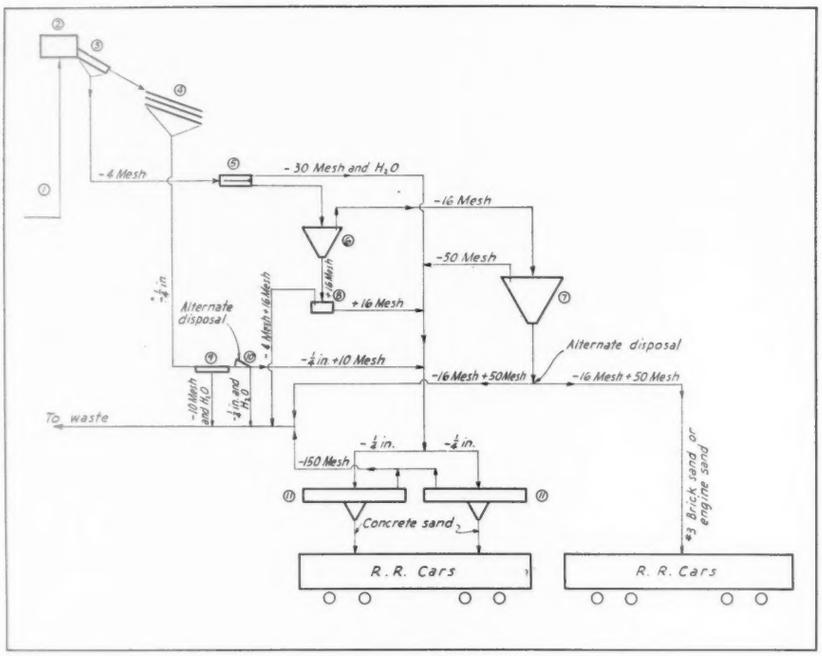
Looking down on the 6-ft. and 8-ft. cones and the two 15-ft. rake classifiers.

Cars being loaded with sand under the two 15-ft. rake classifiers.

The small amount of coarse sand not removed at the gravity screens passes through the bottom decks of the vibrating screens along with the water from the sprays on these screens. This material passes through a flume, in the bottom of which there is a 2-ft. by 6-ft. Hendrick launder screen with 10-mesh slotted perforations to remove the fines and water to waste. An adjustable gate beyond this screen allows the material passing over the launder screen ($\frac{1}{4}$-in. to 10-mesh) to be diverted to waste or to be passed on to the recovery bowls as desired.

The sand-classifying plant consists of two Nordberg-Wood Auto-Vortex classifiers, one 6 ft. and the other 8 ft. in diameter, and two 15-ft. diameter Nordberg-Wood rake-type bowl classifiers. The latter discharge automatically into cars on a loading track below. No power is required for the Auto-Vortex classifiers, which depend on the rush of the incoming water and solids to maintain a circular movement and a vortex in these classifiers. The revolving rake mechanism in each of the bowl classifiers is driven by a 3-hp. motor through a Palmer-Bee speed-reducer.

About 4,500 gal. per min. of water and solids is pumped to the plant. As this volume of water would overload the classifying cones some of it is by-passed. The water and most of the minus 16-mesh sand are taken out by the gravity screens and enter a 36-in. wide totally-inclosed flume which has a slope of about 3 in. per ft. In the top of this flume are 8-in. vertical "equal-



Flow-sheet of the Montgomery sand plant. Encircled figures refer to the following equipment: 1, Discharge line from dredge; 2, Discharge box; 3, Gravity screen; 4, Triple-deck vibrating screen; 5, Adjustable splitter valve; 6, Auto-vortex classifier (6 ft.); 7, Auto-vortex classifier (8 ft.); 8, Adjustable surge box; 9, Launder screen; 10, Adjustable gate; 11, Rake classifier.

of material which invariably feed into it. This box has sufficient capacity so that it can continue discharging material during the short periods when it is not being fed.

This cone is about 99 per cent. efficient on its overflow, and its spigot discharge contains less than 2 per cent. of minus 50-mesh and only a trace of minus 100-mesh material.

The overflow (minus 16-mesh) from the 6-ft. cone comprises the entire feed for the 8-ft. cone. As its feed is more uniform and contains considerably less solids than the feed to the 6-ft. cone the 8-ft. cone is the more efficient of the two. A real correction is made by this cone, as 98 per cent. of its spigot discharge is 16- to 50-mesh and it is either wasted or loaded and sold as a very high grade engine sand. This material is loaded direct into cars. By adjusting this classifier it is also possible to produce a special No. 3 brick sand for which there is a ready market.

The overflow from the 8-ft. cone is theoretically minus 50-mesh material, but the break is actually being made nearer 40-mesh in order not to lose too much of the minus 50-mesh material.

izer" pipes 4-ft. high which help to smooth out surges in the flow. Water rises in them and air can escape through them. In the flume is an adjustable horizontal splitter valve which diverts the excess water along with some of the finer sand away from the 6-ft. cone. As a result some of the sand is not processed, but this is permissible as there is no necessity for taking out all the 16- to 50-mesh material. By-passing this excess water and fine sand also gives a more uniform feed to the classifiers and prevents overloading them.

The water and sand not diverted are discharged from this flume to the 6-ft. diameter Auto-Vortex classifier, which is set to throw over minus 16-mesh material to the 8-ft. cone. Both cones have automatic spigot discharges controlled by counterweights. The spigot discharge of the 6-ft. cone comprises most

Another view of the plant, showing the classifiers and waste flume.

A close-up view of the 6-ft. and 8-ft. cone classifiers with flume from screens at right.

of the sand and its discharge must be regulated to control the recombining of the sand fractions in the rake classifiers. Surges here will unbalance the whole system. Accurate control is achieved by means of a "surge box" of about ½-cu. yd. capacity installed under this cone. The "soupy" sand from the 6-ft. cone spigot is discharged from the bottom of this box through adjustable sliding gates to the bowl recovery tanks. By setting these gates at the desired opening a steady feed to the bowls is assured. The excess material not to be recombined overflows the box to a waste flume along with all the surges

This material combines in a flume with the minus 30-mesh material diverted at the splitter valve, most of the plus 16-mesh product of the 6-ft. cone, and a selected part of the comparatively small amount of ¼-in. to 10-mesh material passing through the bottom decks of the vibrating screens. This composite material is split equally to the two 15-ft.-diameter bowl classifiers in which the mixing action of the rake mechanisms insures a uniform product. These rakes operate at 1½ r.p.m. The specification concrete sand produced is discharged from the automatic bowl spigots direct into cars for shipment.

The plant installed to produce additional coarse gravel. At the time this picture was taken the flood waters had not yet receded enough so that operation could be resumed.

The overflow of water and silt (minus 150-mesh) goes to the waste flume previously mentioned and is discharged back into the lake.

There are three loading tracks at this plant, one under the gravel bins, one under the sand-recovery bowls for loading concrete sand, and one alongside the plant for the loading of brick or engine sand. As the sand must be loaded as it is produced and as the capacity of the gravel bins is small a constant supply of empty cars is necessary. Two switch engines are used to insure against delays. The dam is about 100 mi. northwest of Montgomery and deliveries are made via the Mobile & Ohio Ry.

The original contract for aggregates provided that about equal quantities of sand, small gravel and coarse gravel would be used. It later developed that more coarse than fine gravel was needed, and to meet this new demand the company installed a new plant for the supplementary production of this material. This plant, which went into operation in February of this year, is located in a section of the lake which had previously been excavated to a point where there is a comparatively high percentage of coarse gravel. When the present contract is completed this plant may be used for the production of coarse paving gravel.

Close-up view of the coarse gravel plant showing the vibrating and stationary screens.

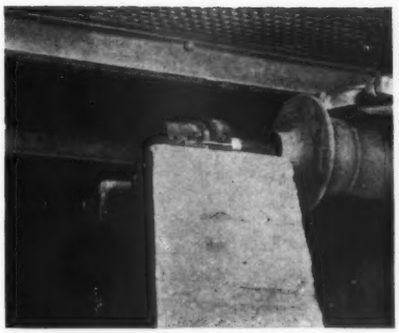
At the time of the writer's visit this plant was shut down due to the high water. Material is supplied to the plant by an old dredge with a 10-in. by 8-in. Amsco Type M pump driven by a 150-hp. motor. The material is pumped about 400 ft. against a vertical head of about 25 ft. into a rubber- and steel-lined box. The material flows out of the box on a 6-ft.-square Hendrick inclined flanged-lip gravity screen which has ⅝-in. by ⅞-in. by 6-in. staggered openings. All the material passing through these openings goes to waste. Everything passing over this screen goes to a 3-ft. by 10-ft. Nordberg-Symons 2-deck screen. This screen has 1-in. and 1¼-in. openings on the top deck and ¾-in. and ⅞-in. openings on the bottom deck. Anything passing through the bottom deck is also wasted. As less than 5 per cent. of the gravel produced is over 1½ in. in size it is not necessary to scalp off any of this material. The gravel retained on both decks (¾-in. plus) is discharged on a Barber-Greene portable conveyor having a 24-in. by 50-ft. belt for direct loading into cars.

This plant produces from 25 to 40 tons per hr. of coarse concrete gravel, which is about 20 per cent. of the total input to the plant.

Hard Facing *(from page 44)*

Another midwestern plant found that hard-facing conveyor-shaft sleeves afforded an easy method of eliminating lost production time. The steel sleeves under the severe operating conditions met in the conveyor lasted an average of 6 days. New sleeves cost $9 each, and it usually requires two men at least half a day to replace one set. The value of time at this plant was estimated at $250 per hr. Accordingly, it cost more than $1,000 in production time every time a set of sleeves was replaced. As an experiment, it was decided to hard-face one set of sleeves, and after six weeks of constant use the hard-faced sleeves showed only slight signs of wear.

Little applications such as this can mount up to almost incredible savings. A rather important use of hard-facing, and, incidentally, one which has been standard for a number of years with a large manufacturer of compressed-air lines for conveying cement through the mill, is the application of hard-facing



Replacing drag-chain shafts in the pit requires that the whole kiln be shut down. Hard-facing reduces the wear and frequency of shutdowns.

alloy to conveyor-pipe bends. Where the conveyor pipe is curved, the fine, naturally-abrasive cement wears very quickly through the steel-pipe wall from the inside. To eliminate this permanently the curved portion of the pipe is first cut in halves longitudinally by an oxy-acetylene cutting torch. Hard-facing alloy is then applied to the inner wall on the outside of the curve, and the pipe is welded back together. This treatment has practically eliminated the necessity of shut-downs for replacing worn conveyor pipes.

Hard-faced clinker plows usually give more than four times as much service as chilled-iron plows. Bearings, bushings, dies, pump air-rings, crusher mantles, pulverizer hammers, bucket-elevator teeth and sprockets, and innumerable other parts may be both economically and efficiently treated with hard-surfacing alloy.

The hard-facing process has spread so rapidly that it is now of major importance in every industry. This is advantageous from the standpoint that many applications which have been confined to but one or two industries are now being made more universally to the advantage of all. One of the most important developments which has recently come about is the application of this hard-facing alloy to gate and globe valve seating surfaces for high-temperature, high-pressure steam service. Numerous tests have shown that under severe conditions of steam-valve operation hard-faced valve seats will last from three to ten times longer than ordinary materials.

It has been estimated that many cement plants carry inventories of spare parts amounting to at least 7 per cent. of the total plant value. This is often necessary because of the abrasive action of the materials normally handled by the industry. Because hard-facing can reduce this inventory and effect such decided replacement savings as well, it has gained wide acceptance in the cement industry.

DUST DISEASES AND LAWS

By C. O. SAPPINGTON, M.D.

Consulting Industrial Hygienist

BECAUSE of recent attempts to modify and standardize occupational-disease disability legislation, many employers seem to be under the impression that dust problems in industry are fairly well settled. This attitude prevails to a certain extent even in states where occupational-disease disability legislation has been in force over a period of many years, and in such states this conception is not limited to employers.

That this opinion is erroneous seems to be well borne out by compensation experiences as well as common-law actions in various states within recent years. A statement of a prominent authority on this subject is of further interest: "Silicosis at present is the overwhelmingly absorbing problem of industrial hygiene, for it affects many thousands of workers, stone cutters and quarrymen, miners of metals and of anthracite, sandblasters, potters, foundrymen, makers of abrasive soaps and powders, to mention only a few of the occupations which produce silica-containing dust. This disease has created a very difficult situation for both employers and employed, because it is new to both groups." (Dr. Alice Hamilton in *Industrial Medicine,* Jan. 1938, p. 52).

Moreover it is believed that many employers and employees do not know what their rights are under existing statutory requirements in the various states, what the differences and similarities in these requirements may be under certain conditions, what the type of coverage is, and other important considerations.

This article, therefore, although not exhaustive, will attempt to point out what these provisions are, as well as give samples of code provisions, types of commission cases which have been filed, reviews of certain court decisions, and, finally, a general discussion with recommendations for future guidance.

Statutory Provisions

This subject will be developed in two phases: the type of coverage in the various states, and the rights of employers and employees under these statutory provisions.

Type of coverage may easily be classified according to four groups: Group I, states with "blanket" coverage, which means that the laws provide for general coverage of all occuptional diseases; Group II, states with "schedule" coverage, which means that these states mention dust diseases of specific types, according to the exceptions noted; Group III, states which do not have a true "schedule" list, but make certain provisions; and Group IV, including states which make no provision for statutory coverage of dust diseases.

Group I (States with "blanket" coverage).—California, Connecticut, Illinois, Indiana, Missouri, North Dakota, Wisconsin.

California includes any disease or injury arising out of employment.

Connecticut provides that "injury" or "personal injury" include only accidental injury, which may be definitely located as to the time when and the place where the accident occurred, and occupational disease defined as one peculiar to the occupation in which employee was engaged and due to causes in excess of the ordinary hazards of employment as such.

Illinois and *Indiana* define occupational disease at some length.

Missouri makes provision for inclusion subject to employer and employee election.

North Dakota provides that "injury" includes any disease approximately caused by the employment.

Wisconsin states that "injury" means mental or physical harm to an employee caused by accident or disease.

Group II (States with "schedule" coverage): Michigan, New York, North Carolina, Ohio, Pennsylvania, Washington.

Michigan provides for stoneworkers' or grinders' phthisis in quarrying, cutting, crushing, grinding or polishing of stone, or grinding or polishing of metals, for silicosis in mining, and for pneumoconiosis in quarrying, cutting, crushing, grinding or polishing of metal.

New York, while not mentioning silicosis or any other dust disease in its original schedule, later provides for any and all occupational diseases and also sets up regulations of a special type for silicosis.

North Carolina provides for asbestosis and silicosis, without naming occupations or processes.

Ohio names silicosis, defines the disease, and sets up special regulations regarding it.

Pennsylvania mentions silicosis and anthraco-silicosis in any occupation involving direct contact with the handling of or exposure to dust of silicon dioxide (SiO_2), and asbestosis in any occupation involving direct contact with the handling of or exposure to the dust of asbestos; special regulations are also included regarding silicosis and asbestosis.

Washington, although not mentioning any specific dust disease in its schedule, states in the last paragraph of the schedule "and any persons employed in any industry where intense dust prevails."

Group III (States which do not have a true schedule list, but make certain provisions).—Kentucky, Massachusetts, Nebraska, West Virginia.

Kentucky provides for election on the part of employers and their employees engaged in the operation of glass-manufacturing plants, quarries, sand mines, or in the manufacturing, treating or handling of sand, with respect to the disease of silicosis caused by the inhalation of silica dust.

Massachusetts does not make express provision for the coverage of occupational diseases, but certain injuries have been construed as including certain diseases as contracted in the course of employment.

Nebraska includes occupational diseases which arise out of and during the course of employment and are peculiar to the smelting, metal-refining, and battery-manufacturing industries.

West Virginia has what may be termed a silicosis act and provides only for that disease.

Group IV (States which make no statutory provisions for coverage of dust diseases)—Alabama, Arkansas, Arizona Colorado, Delaware, Florida, Georgia, Idaho, Iowa, Kansas, Louisiana, Maine, Maryland, Minnesota, Mississippi, Montana, Nevada, New Jersey, New Hampshire, New Mexico, Oklahoma, Oregon, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, Virginia, Wyoming.

Most of these states provide for compensation for disability arising from injury only; some of the states have schedules and do not mention any dust disease; a few have no compensation provisions for either disease or injury.

Statutory provisions relative to different types of coverage are distinctly modified, however, by provisions relating to the rights of election of the employer

and the employee and the availability of a common-law remedy. These regulations may also be grouped according to states.

In *California* and *Wisconsin* compensation coverage is compulsory and common-law actions are abolished except as to specified employers and employees; in *Washington,* compensation coverage is compulsory and common-law actions are abolished.

Group A (Includes states in which: [1] employees and employers have the right of election or rejection of compensation provisions; [2] when both elect, the common-law remedy is abolished; and [3] when the employer elects and the employee rejects, the latter retains a common-law remedy and common-law defenses are available.)—Connecticut, Delaware, Illinois, Indiana, Kentucky, Massachusetts, Michigan, Minnesota, Missouri, Nebraska, New Jersey, New York, North Carolina, North Dakota, Ohio, Pennsylvania, Rhode Island, West Virginia.

In *Illinois* and *Indiana* employees have no right of election.

In *Massachusetts* election is compulsory for the employer under certain circumstances where employees work on machinery.

In *New York* the act is compulsory for employers as to enumerated "hazardous" employments and elective as to others.

Group B (States providing that when the employer rejects, the employee has a common-law remedy with common-law defenses denied.)—Connecticut, Delaware, Illinois, Indiana, Kentucky, Massachusetts, Michigan, Minnesota, Missouri, Nebraska, New Jersey, New York, North Carolina, North Dakota, Ohio, Pennsylvania, Rhode Island, West Virginia.

In *Illinois* and *Indiana* in death cases the limitation of the employer's liability is $10,000.00.

In *Kentucky* and *West Virginia* if the employer fails to elect, he retains common-law defenses.

In *New York* employees may maintain common-law actions or obtain compensation under the statute.

In *Ohio* the employer is also subject to receivership proceedings.

Group C (States providing that when both reject, the employee has a common-law remedy and common-law defenses are available.)—Connecticut, Delaware, Kentucky, Massachusetts, Michigan, Minnesota, Missouri, Nebraska, North Carolina, North Dakota, Rhode Island.

In *Pennsylvania,* although there is no provision under this grouping, negligence is presumed from the discharge of an employee within a year of physical examination and his failure to obtain work within six months after his discharge.

Code Provisions

Code provisions may or may not have the effect of law and are formulated by different bodies, sometimes by departments of labor, also by industrial commissions. Although we are restricting our discussion to dusts, sometimes these code provisions are issued as "safety orders".

It is impractical in this article, because of space involved, to mention all the state codes and to discuss the types of provisions of all the state codes relative to dust problems, but some typical provisions can be mentioned.

As an example of a recent and well-developed code, reference is made to *Dusts, Fumes, Vapors and Gases Safety Orders,* as issued by the Department of Industrial Relations of the Industrial Accident Commission of the State of California, effective December 28, 1936. This code contains the following items:

(1) *Applications.*—Every place of employment where a work or process is carried on by which dusts, fumes, vapors, or gases of a harmful nature are produced or generated or exist independently of the work or process, and which may be inhaled in quantities or concentrations that constitute harmful exposure as later defined, or be in any manner injurious to health.

(2) *Definitions.*—These include definitions of the expressions "general ventilation," "gravity system of ventilation," "mechanical system of ventilation," "exhaust system," "local exhaust ventilation," "hood," "duct," "fan," "separator," "refuse receptacle," "approved," "dust," "fumes," "vapor," "gas," "harmful," "isolated operation," "silica, meaning free silica," "singular and plural numbers".

(3) *Harmful Exposure.*—The commission recommends that the named limiting concentrations be used as a basis for determining the existence of a health hazard in places of employment, and names the concentrations for a group of well-known fumes, gases and vapors. Regarding dusts, the concencentration named for free silica is 10 million particles of a size between 0.5 and 5 microns per cu. ft. of air, for asbestos, 10 million particles of a size between 0.5 and 10 microns per cu. ft. of air, for dusts other than silica and asbestos and those of a toxic nature 50 million particles of a size between 0.5 and 5 microns per cu. ft. of air. Material is also discussed relative to dust counts, referring to the impinger dust-sampling method as described by the U. S. Public Health Service, allowing for other approved methods which for the purpose of comparison should be calibrated with the impinger method, and making provision for standard equipment and competent personnel being used. Chemical analysis is also provided for, to the effect that any standard, reliable method of quantitative analysis will be acceptable.

(4) *General Ventilation.*—Special requirements.

(5) *Local Exhaust Ventilation.*—Where required, general requirements, duration of operations, disposal of exhaust materials.

(6) *Personal Protective Equipment.*—When to be worn, approval required, protection of temporary nature, education in use of equipment required, provision and care of equipment, air supply to positive-pressure equipment, ordinary commercial air filters do not remove carbon monoxide, air pressure to be regulated.

(7) *Substitution of Nonhazardous Equipment, Material or Process.*—Whenever established as practicable.

(8) *Dust-Allaying Media.*—Water, oil or chemicals in non-injurious quantities and with such frequency as may be necessary.

(9) *Isolation of Hazardous Operations.*—Unless control is effected through other provisions.

(10) *Sanitation and Cleanliness.*—Housekeeping, provisions for cleaning, shower baths, lavatories, and the like, sanitation of respiratory equipment.

(11) *Penalties for Violation of Orders.*

As an example of a special code for application to certain industrial groups, the New York code for rock-drilling may be mentioned. This provides briefly, that where the rock contains 10 per cent. or more of free silica by weight, a maximum of 10 million particles of dust per cu. ft. of air is allowed; where less than 10 per cent. by weight of free silica occurs, a maximum of 100 million particles of dust per cu. ft. of air is allowed.

Regulations for the use of parting compounds (a product of interest to nonmetallic-mineral producers) have been set up in California, where they are permitted with not more than 1 per cent. of free silica, and in New York with not more than 5 per cent. of free silica.

The excellent work of the U. S. Bureau of Mines in issuing procedures for the testing of permissible types of respiratory protective equipment and also the approval of such devices officially, may also be classified as codes. It is expected that most states will follow the approval procedures and approvals of the U. S. Bureau of Mines.

As an example, the following is quoted from the Safety Orders of the Industrial Accident Commission of the State of California, referred to above:

"Approval of equipment by the In-

dustrial Accident Commission will, in all cases, be based on standards at least equivalent to the U. S. Bureau of Mines. Approval of equipment for which the U. S. Bureau of Mines has not established standards shall be contingent upon proof of its merits satisfactory to the Industrial Accident Commission."

Compensation Cases

Disease claims for disability arising from dust diseases naturally vary greatly in the different states, according to the statutory provisions. As examples of these experiences, the figures from New York and Connecticut certainly represent unique situations.

In Metropolitan New York during 1936, for instance, of a total of 1,036 disease-claims closed, there were only three claims for silicosis and all these were denied awards. It should be recalled, however, that previous to 1936 New York had not inserted a provision in its schedule list including "any and all occupational diseases". Subsequent to this in 1937 New York also included specific statutory regulations for the administration of silicosis claims.

In Connecticut during the fiscal year, July, 1935 to June, 1936, 10 cases of silicosis were reported by physicians, and 11 cases were compensated for disability, but the latter had not been reported by physicians.

In Wisconsin, where occupational diseases were made compensable by law in 1919, the picture is somewhat different. During the 10-year period 1920 to 1929 inclusive of the 3,019 cases of compensated occupational disease, irritant dusts and fibers accounted for 13.1 per cent., or a total of 396 cases.

The types of cases which are likely to occur under new statutory provisions for compensation for disability for dust diseases are interesting, but there have not been many opportunities to observe what happens under such conditions. The new occupational-disease disability compensation law for the State of Illinois went into effect on October 1, 1936. As an example of what may occur during the first year of the operation of such a law, there were 220 cases filed before the industrial commission during the first year of operation of the law; of these the following were the causes for complaint as registered on the applications: lead poisoning, 47 cases; indefinite complaints, 41 cases; silicosis, 33 cases; miscellaneous complaints, 28 cases; tuberculosis, 23 cases; dermatitis, 20 cases; miscellaneous pulmonary diseases, 14 cases; silico-tuberculosis, 11 cases; and asbestosis, 3 cases.

Court Decisions

Court decisions form a very valuable background of opinion regarding important points of controversy and also demonstrate legal trends. Such opinions involve the consideration of medical and legal evidence and are, therefore, really medicolegal opinions. Sometimes the decisions are rendered on appeals from lower courts and sometimes on compensation cases sent up for review.

Interestingly enough, a greater number of cases of silicosis have been sent to higher courts for review and decisions than of any other type of occupational disease. The following decisions have been abstracted for the purpose of showing various questions which are involved, as well as the rulings on the medicolegal evidence presented. It should be kept in mind when reading these decisions that in many of them reference has been made to the statutory requirements in various states where such requirements exist; it should also be emphasized that it is the duty of the court to interpret such statutory legislation which is in force, or to point out that there is no statute which is applicable to the case in point.

Silicosis; Safe Place to Work; Failure to Prove Silicosis Resulted During Period Complained of. (New Jersey)—The plaintiff sued for injuries resulting in silicosis. The decedent died from cancer. Respirators were provided, but not during the one-year period of which plaintiff complained.

It was for the jury to determine whether the decedent inhaled dust during the period mentioned, whether respirators should have been furnished, and the question of the adequacy of the ventilating system.

Proof was lacking that the dust contained any silica, that it was 10 microns or less in size, that it existed in such concentrated amounts, and that the decedent was exposed for a sufficient length of time to cause silicosis.

The rule, that an industry carried on in a lawful manner, though its operation produces dust in small or large quantities, is *per se* negligent, has not been adopted. To hold that the existence of dust is *prima facie* evidence of negligence would violate the rights of operators and also the presumption against negligence. Motion for nonsuit granted.—*Cichocki, Executrix* v. *Geigy Co., Inc.* (183 Atl. 463). New Jersey, Hudson County Circuit Court. Decided January 6, 1936.

Silicosis; Compensation Denied; No Wage Loss Prior to Termination of Employment. (Wisconsin)—Until there is an actual wage loss caused by occupational disease, there can exist no compensable disability under the Workmen's Compensation Act. The applicant did not become disabled because of his silicosis until after the termination of his employment. Judgment reversed; court below instructed to set aside award of Commission and dismiss application.—*Chain Belt Co. et al.* v. *Industrial Commission et al.* (264 N. W. 502). Wisconsin Supreme Court. Decided January 7, 1936.

Silicosis; Date of Disability; Wage Loss. (Wisconsin)—Disability as used in the 1933 amendment must be defined as an injury which causes a wage loss. The question is, what is meant by "wage loss"? Considering that the claimant is incapable of more than slight physical exertion, that by reason of his physical incapacity due to silicosis he can be employed only in occupations which involve so-called light work, there is evidence which sustains the finding of the commission that he has sustained a wage loss which, measured by the rate of compensation he had theretofore received, amounts to 50 per cent. Judgment affirmed.—*Schaefer & Co. et al.* v. *Ind. Com. et al.* (265 N. W. 390). Wisconsin Supreme Court. Decided February 4, 1936.

Pneumoconiosis; Inhalation of Dust; Violation of Labor Law; Statutes of Limitations. (New York)—The plaintiff alleged the inhalation of dust and the contraction of pneumoconiosis, that the employer was thereby negligent. The plaintiff's employment ceased more than three years before the action was commenced.

The injury to the plaintiff was complete when the alleged negligence of the defendant caused the plaintiff to inhale deleterious dust. For that injury, including all the resulting damages, the defendant was then liable.

The statute provides in unambiguous language that the period of limitation begins to run at the moment when the right to begin an action accrues. This court concurred in the opinion that the causes of action were all subject to the three-year period of limitation.

Regarding the charge that the defendant failed to provide the safeguards required by the labor law, the court ruled that the liability for a disregard of statutory duty was really "created" by statute. Judgments modified in accordance with this opinion and, as so modified, affirmed.—*Schmidt* v. *Merchants Dispatch Transp. Co.* (200 N. E. 824). New York Court of Appeals. Decided March 3, 1936.

Silicosis as Result of Employer's Negligence; Right to Common-Law Action; No Recovery Under Act. (Georgia)—The Workmen's Compensation Act can not be applied except in case of injury "by accident". The remedy provided by this statute is exclusive within the field of its operation, but does exclude redress in cases to which it is not applicable.

If the act does not apply to an "occupational disease" caused by injuries which were "not the result of an accident and were not compensable under the provisions" of the act, the employee may maintain an ordinary or common-law action for damages against his employer, provided a cause of action exists in his favor under the law relating to the liability of a master, independently of the Workmen's Compensation Act. The right "to bring an ordinary action for damages" is not excluded by this statute as to injuries which do not fall within its terms.—*Covington* v. *Berkeley Granite Corp.* (184 S. E. 871). Georgia Supreme Court. Decided March 24, 1936.

Silicosis; When Right to Compensation Accrues; No Wage Deduction for Time Lost. (Wisconsin)—The commission appealed a judgment vacating an award, holding that the insurer was liable, being on risk at the time of the first lost-time period (ascribed by the commission to silicosis), although the disease was not discovered until six months later.

Because the employer made a gift to the employee of wages legally lost did not obviate the effects of that loss as far as compensation for permanent disability through silicosis is concerned. A recovery can not be had for the amount of the wages paid by the employer for lost time, but the recovery herein was limited to compensation for the permanent disability found. Reversed with directions to enter judgment confirming award.—*General Accident, Fire & Life Assurance Corp.* v. *Indiana Commission, et al.* (266 N. W. 226). Wisconsin Supreme Court. Decided March 31, 1936.

Silicosis; Sufficiency of the Declaration. (West Virginia)—This writ of error involves the sufficiency of the declaration in a silicosis case, the demurrer to the declaration having been sustained by the court below. The defendant contends that the declaration shows no causal connection between the plaintiff's alleged silicosis and his employment, and no failure of the defendant's duty, but does show that the plaintiff failed to use ordinary care and that his alleged action is barred by the statute of limitations.

Scott v. *Rinehart & Dennis Co.* (116 W. Va. 319, 180 S. E. 276)—a silicosis case relied on by the defendants—is clearly different from this case. There the action was not brought until nearly two years after the cessation of the employment; here the plaintiff's action was brought in the fall of 1934 and within a year from the alleged contraction of the disease.

It was held that the defendant's strictures on the declaration are not well taken and that the demurrer should have been overruled. Where an employee without fault himself contracts an occupational disease because of the negligence of his employer, the latter must respond in damages. Judgment reversed.—*Blatt* v. *United Zinc Smelting Corp., et al.* West Virginia Supreme Court of Appeals. Decided October 6, 1936.

Silicosis; Third Stage When Discovered; Defendant's Negligence as Cause; Insufficient Evidence. (Missouri)—The first action resulted in a verdict for $27,000 against the defendant, upon which the defendant appealed. The plaintiff was exposed to dust created by operations and the petition alleged several grounds of negligence, especially the failure to provide protective devices and to provide examinations, as well as notice of danger, all of which were charged as violations of the statues.

The question is whether the injury resulted from dust inhaled by the plaintiff while an employee of the defendant, although evidence amply sustains the charge that the defendant failed to perform some of, and possibly all, the statutory obligations, which constitutes negligence *per se*. The evidence shows that the plaintiff worked from 1921 to 1929 for the defendant, quitting during the latter year because he felt that his health was being impaired. The disease was said to be in its "third stage" at the time of the first examination in October, 1932. There was no support for a finding by the jury that the plaintiff's employment by the defendant in 1929 caused him to contract silicosis. The evidence sufficiently establishes the fact that the employment by the defendant from 1921 to 1925 was of sufficient duration to have caused the injury, but there is no evidence upon which a conclusion can be based that the disease of silicosis could be contracted and then remain dormant and unnoticed from 1925 until some time in 1929. The plaintiff, to recover, must make a complete case pointing to the defendant's negligence as the cause of the injury. The defendant's demurrer to the evidence should have been sustained. Judgment reversed.—*Bieser, Administratrix v. Goran* (100 S. W. (2d) 897). Missouri Supreme Court. Decided November 12, 1936.

Silicosis; Statute of Limitations; When Statute Begins to Run. (Pennsylvania)—The defendant appeals from the orders of the Court of Common Pleas granting a new trial. The plaintiff alleged that he suffered an occupational disease resulting from the defendant's violation of the statute regulating employment in industrial establishments, contending that the defendant did not supply a reasonably-safe place in which to work measured by the statutory requirement. The defense maintained that action is barred by the statute of limitations, which was two years. In the opinion granting the new trial the trial judge stated that the finding "that the plaintiff last worked within the two-year period is against the weight of the evidence on that issue. Since the verdict is necessarily premised upon that finding, the verdict can not stand and the entire case must be retried." The plaintiff contended that for occupational disease the time should not begin to run until the plaintiff knew or should have known that he had the disease either during the period of employment or at any time after the employment ended.

The court held that the limitation period begins when the breach of duty to provide a reasonably-safe place to work occurs. The master's failure to perform his duty is regarded as a single wrong continuing so long as the employment continues, and such wrong must be redressed by action brought within two years and not thereafter from the time when the employment terminates. It is immaterial that the first symptoms of the disease were misunderstood to indicate pleurisy; it now appears that as a result of the work the man was suffering from incipient silicosis and even though it began prior to the termination of his employment and matured afterward, he is entitled to recover all the resulting damages of which he can offer proof down to the time of the trial as in other cases. Judgment affirmed.—*Plazak v. Allegheny Steel Co.* Pennsylvania Supreme Court. Western Dist. Decided November 23, 1936.

Silicosis; Grinder at Tile Plant; Construction of Safety Statutes; Requisites to Recovery. (Missouri)—The Plaintiff obtained a verdict for $11,041.66, claiming the contraction of silicosis because of the defendant's alleged failure to comply with statutory requirements. The defendant appealed. The plaintiff was permitted to file a second amended petition which changed the allegation of working during 1931, 1932 and 1933 to 1928, 1929 and 1930. The defendant claimed that this added a new cause of action.

The court held that both the original and the amended petitions adhere to the injury originally declared upon and it was proper for the court to allow this amendment. The fact issues upon which the plaintiff had the burden of proof, and which the plaintiff's instructions authorizing a verdict should have required the jury to find in the plaintiff's favor, were: (1) Is silica dust a noxious, poisonous or disease-producing dust? (2) Is there a disease of silicosis, which is peculiar to or the natural

result of exposure to the continuous breathing of silica dust? (3) Was silica present in the dust produced by the defendant's grinders in such form and quantity as to produce the disease of silicosis? (4) Could exposure to the dust produced by the defendant's grinders during the time when and in the manner in which the plaintiff was working about them or any of them produce the disease of silicosis? (5) Did the hood and suction fan of the new Bridgeport grinder effectively prevent the production of dust in such form and quantity as would produce the disease of silicosis? (6) Did the plaintiff have the disease of silicosis? (7) Did the plaintiff contract the disease of silicosis from being caused to breathe dust produced by reason of the defendant's failure to comply with any of the statutory provisions? Since the standard here fixed by statute is no more definite than the common-law standard, it required construction in order to determine what standard it meant to set up for employers.

The defendant's contention that the certificates of approval of condition in its plant after inspection by the Commissioner of Labor constituted a defense is without merit. The duty to comply with both the specific requirements and general standards of these statutes is an absolute and mandatory duty which is directly placed upon the employer by the legislature and does not depend upon any approval or disapproval of the Commissioner of Labor. Judgment reversed and the cause remanded.—*Smith, Executrix v. Harbison-Walker Refractories Co.* (100 S. W. (2d) 909). Missouri Supreme Court. Decided December 14, 1936.

Silicosis; "Bench Mark of Safety"; Statute of Limitations; Contributory Negligence. (New Jersey)—The plaintiff appealed to recover damages for injury caused by a breach of duty of the defendant in failing to provide and maintain proper and sufficient ventilation for removing dust from the premises where the employee worked. Most of this work was done in a laboratory in a crushing room. It was alleged that the plaintiff had contracted pneumoconiosis or silicosis with superimposed tuberculosis. The plaintiff was not advised of a change from a partnership to a corporation and his employment continued as though there had been no change. The testimony of plaintiff's witnesses was attacked by the defendants on the ground that the testimony failed to take into account well-established standards that only air containing at least 15 million particles per cu. ft. with 35 per cent. silica, is harmful or injurious.

The court held that the evidence does not support the claim that there is any such standard. The evidence also indicates that the plaintiff sustained the diseases alleged. Regarding the partnership incorporation, whenever two or more persons cause a single injury, not assignable in parts to the respective wrongdoers, they are liable as joint tort feasors, even though their acts are successive in point of time, concurrence in result being all that is required to establish joint liability.

No proof has been adduced to show that the plaintiff's cause for action, or any part, is barred. The evidence shows that the cumulative effect of the continuous inhalation of silica dust over a period of time produces the disease. It is only when the normal functions of the body in eliminating the foreign particles fail that the disease develops. There is no injury until that time. The defendants' contention ignores the applicable rules of law which make consequential damage or injury the very gist of the action. The verdict is against the defendants on the point of defense of contributory negligence. Reversed, with directions to enter judgment for plaintiff on the verdict.—*Golden, Administratrix v. Lerch Bros., Inc. et al.* Minnesota Supreme Court. Decided February 19, 1937.

Silicosis; Whether Accidental Injury. (Georgia)—Held that where, as the result of an employer's negligence, an employee breathes quantities of granite dust over a period of time and in the course of his employment, and the breathing of said dust causes the disease of silicosis, such disease is not the result of an injury or accident within the meaning of the Georgia workmen's compensation act, and is not compensable thereunder. The judgment of the Court of Appeals, in so far as it holds that the disease of silicosis, contracted by the employee under the circumstances alleged in the petition, is not accidental within the meaning of the compensation act and not compensable thereunder, is affirmed.—*Berkeley Granite Corp. v. Covington.* Georgia Supreme Court. Decided February 11, 1937.

Silicosis; Statute of Limitations; Amendment to Show Phosphate Poisoning; Whether Allowable. (New Jersey)—The plaintiff recovered a verdict for injuries alleged to have been sustained while employed in the defendant's chemical factory. The trial judge concluded that the plaintiff had failed to prove knowledge on the part of the defendant, and entered judgment for the defendant.

Held that the verdict should have been directed for the defendant because of two-year statute of limitations. The plaintiff alleged that he was employed as a furnace man in the silicate department and that there was a failure to provide adequate safety standards and proper ventilation. Some time in 1932 he was transferred to the phosphate department, the action based upon negligence in the silicate department being therefore outlawed by the New Jersey two-year limitation period. The plaintiff undertook to prove that injuries were sustained through negligence in the conduct of the phosphate department and obtained leave to amend his complaint. The court should have refused to allow the amendment. This was a different cause of action from that set forth in the original complaint and therefore could not be introduced after the statute of limitations had run. The negligence alleged in the amendment involved a different act, different buildings, departments, conditions, and dates of exposure. Judgment affirmed. —*Maty v. Grasselli Chemical Co.* United States Circuit Court of Appeals, 3rd Circuit. (New Jersey). Decided April 2, 1937.

Silicosis; Violation of Disease-Prevention Statute; Statute of Limitations; Extent of Recovery. (New York)—An appeal from a judgment for the defendant, entered on a verdict, in an action to recover for death due to silicosis. The deceased was a sandblaster working on the renovation of cars either in a yard in the open air, or under a shed without sides, and repeatedly refused to use protective devices provided by the employer. Sec. 299 (2) New York Labor Law requires that "all machinery creating dust shall be equipped with proper hoods and pipes connected to an exhaust fan of sufficient capacity and power to remove such dust". The State Industrial Board's Rule 741 reads: "Dust created in quantities tending to injure the health of employees in any business which involves the use of silica shall be removed by means of suction devices as far as practicable at the point of origin". The judge ruled that neither the section nor the rule required the defendant to install suction devices and left the case to the jury on common-law principles. The deceased began an action on July 5, 1932. He died on April 19, 1933. This action was begun on February 8, 1934. The judge charged the jury that if the deceased contracted silicosis before July 5, 1929, the plaintiff could not recover.

Held that it would be unwarranted to limit subdivision two to workrooms; it applies generally to all "factories" and a "factory" includes an open yard such as that in which this work went on. It does not however follow that it covered the deceased's work, that depending upon its inherent appropriateness to the "machinery" which he used. Rule 741 added nothing as it required suction de-

vices only "so far as practicable". Perhaps a jury might have found that such devices were practicable in the defendant's yards, but the deceased's continuance at work was an assumption of any risk resulting from their absence. The judge was therefore right to take the statute and the rule out of the case. The fact that the deceased could not have recovered if he had left the defendant's employ on or before July 4, 1929 did not affect his right to recover at least for the period between July 5, 1929 and September 12, 1931, or for any aggravation of his malady, though already contracted. Similarly, the plaintiff did not lose her right of action to recover for any loss due to his death, even though his lungs had been so far invaded on July 5, 1929 that he would have died of silicosis anyway. However, the measure of the plaintiff's damages will be her pecuniary loss over the period by which the deceased's life was shortened because of his exposure after July 5, 1929. Judgment reversed; new trial ordered.—*Pieczonka, as Administratrix v. Pullman Co.,* United States Circuit Court of Appeals, 2nd Circuit, (New York). Decided April 5, 1937.

Silicosis; Diagnosis of Tuberculosis; Late Claim; Whether Knowledge of Disability. (Wisconsin)—Any action to review an award to the claimant, previously affirmed by the circuit court. For more than forty years the claimant had been engaged in work in stone quarries as a paving cutter. He left the employment of the company in 1927 but returned to it in March, 1930. He worked 141 days when he went to a hospital for a prostate operation and a short time thereafter was again operated upon for appendicitis. August 18, 1931 reëntered employment and worked 43 days until November 18, on which day the plant closed. He became sick in January, 1932 and has been completely disabled since. His condition was diagnosed as tuberculosis and he was advised of it in February, 1932. During the fall of 1934 X-ray films were taken which disclosed a silicotic condition. Shortly thereafter claim was made of disability.

Held that the finding of the commission that the claimant did not know that he had silicosis and its relation to his employment until the latter part of 1934, can not be sustained in view of the undisputed testimony of the claimant himself. It is true that the claimant probably knew nothing about silicosis, but he knew about stone dust and knew that stone dust was causing his trouble and must have known that stone dust was connected with his employment for he had worked for forty years at the same kind of work. That stone dust causes lung trouble is a matter of common knowledge of which judicial notice is taken. Failing to make a claim for compensation within two years from the time when he became aware of his condition and the cause of it, his claim is barred. Judgment reversed and cause remanded with directions to enter judgment setting aside the award.—*Universal Granite Quarries Co. et al. v. Industrial Commission, et al.* Wisconsin Supreme Court. Decided April 27, 1937.

Silicosis; No Wage Loss Therefrom; Disabling Back Injury; Whether Silicosis Compensable. (Wisconsin)—The applicant was injured in 1931 in a mine cave-in, sustaining an injury to his spine. The examiner found that the spine injury constituted a permanent disability of 30 per cent.; he also found that the applicant was afflicted with silicosis but that there had been no lost time and no wage loss from that cause. The spine injury incapacitated the applicant for labor and he had done no work since his injury. The commission found that the applicant sustained an injury through silicosis; that this injury constituted a permanent disability of 50 per cent. in addition to the 30 per cent. disability; and made an award based upon 80 per cent. permanent disability. The commission ruled that as the employer did not notify the applicant that he was discharged, and the employee did not notify the employer that he had quit his job, the relationship of employer and employee existed up to the time of the hearing.

Held that the employment at which the applicant was engaged when injured was automatically terminated by the accident involved, because the applicant was by the accident rendered incapacitated for ever resuming work. As soon as that fact became apparent to both parties, as it immediately or very soon did in the instant case, the employment terminated *ipso facto.* To render the applicant entitled to compensation it would be necessary that evidence exist to show that in the interval between the accident and the time when disability to resume work because of the spine injury became apparent, the silicotic condition so increased of itself to incapacitate him. The record fails to disclose the slightest evidence that appellant's silicotic condition was any worse, or any different, at the time of the hearing than it was at the time of the accident. In the absence of any such evidence the commission's finding of disability from that cause can not stand. Judgment reversed; cause remanded with directions to reinstate the award of the examiner.—*Montreal Mining Co. v. Industrial Commission et al.* Wisconsin Supreme Court. Decided April 27, 1937.

Silicosis; Whether Employee Partnership Valid; Whether Compulsory Act Constitutional. (Wisconsin)—Fifty-one former employees of the company are said to have formed a partnership to operate the company's business. On that basis the employer endeavors to avoid liability to two of their number under the workmen's compensation act. The men were informed that if they wanted their jobs back, they would have to enter into some arrangement which would accomplish the release of their rights to workmen's compensation.

Held that the scheme was so shallow in its conception and so devoid of partnership characteristics in the method of its execution that no partnership of the 51 former employees ever existed. The 51 men contemplated no profits. The partnership was given a lump sum by the company, every two weeks, which just exactly made up the bi-weekly compensation of the men. There was nothing left over. There was no other income. Nor was there any shortage. The partnership never had a loss. The company kept the record of each man's time and the amount due him. It even went so far as to pay the partnership for unemployment-compensation premiums. The men had a definite wage scale. The capital comprised $1 of dues from each member. They owned nothing, paid for nothing (not even overhead), had no expense (not even for their attorney or postage). Both the examiner and the commission have concluded that the applicants Heller and Zellmer were employees of the company. The evidence overwhelmingly bears out this conclusion. The evidence suffices to sustain the commission's finding of two-thirds total permanent in each case.

The question of its constitutional right to contract with its employees for exemption from the compensation act was raised by the company. It is said that no compulsory act like Wisconsin's has been passed upon in this state or elsewhere. It would destroy a quarter of a century of progress in the handling of industrial accidents and disease to adjudicate now that any employer, as a condition to employment, may insist that men must contract themselves out of disability benefits for loss of health or limb or life. Awards confirmed.—*Montello Granite Co. v. Heller et al.* Wisconsin Supreme Court, Dane County. Decided April 26, 1937.

Silicosis; Diagnosis of Tuberculosis; Continued Work; Statute of Limitations. (California)—One of four former employers seeks to annul the award allowed the employee for disability incurred as the result of silicosis acquired in the course of his employment in a mine. The employee is 45 years of age,

began working as a miner for the South Eureka Mining Co. in 1908; from 1918 to 1921 he worked in the Central Eureka Mine; in 1925 he worked for the Argonaut Mining Co. for several months. He shifted from one mine to another for several years, going back in 1929 for a period of time to the Argonaut mine. During 1933, when he was working in the Eureka mine, he noticed for the first time that he was frequently short of breath and felt pains in the chest. A physician told him that he had tuberculosis and advised him to quit mining, but he returned to work for the Argonaut Mining Co. In 1935 he went to work in the El Dorado limestone mine, but soon became incapacitated and ceased working on that account on February 16, 1936. The commission found that the employee sustained temporary total disability and apportioned its aggregate award of $13.42 a week against the four mining companies. The award against the Argonaut Mining Co., the petitioner in this case, is $2.06 per week.

Held that the evidence adequately supports the findings that the claimant incurred and developed silicosis in the course of employment as a miner while working for four companies, and that the disability on this account which caused the termination of his service occurred on or about February 16, 1936. Injuries sustained as the result of occupational diseases are compensable only when the disease culminates in disability. The statute of limitations does not begin to run against a claim for compensation for disability incurred as a result of an occupational disease until the employee knows, or when, by the exercise of due care and diligence, he is presumed to know, that he has an occupational disease which has progressed to the extent that he is so disabled that the efficiency of his work is appreciably affected thereby. Although there is substantial evidence that the employee knew that he was afflicted with silicosis in 1933, there is no evidence that he knew that the disease had disabled him to the extent that the efficiency of his work was impaired until February 16, 1936, when he abandoned the job. There is no merit to the contention that the claim is barred by failure to serve the employer with notice of the hearing within thirty days from the time the claimant first became aware of the fact that he was suffering from silicosis, as required by Sec. 15. Petitioner answered the demand and was represented by counsel at the hearing. No evidence was adduced to show that this company was "misled or prejudiced" by the failure to serve the notice. Award affirmed.—*Argonaut Mining Co., Ltd. v. Industrial Accident Commission et al.* California District Court of Appeal, 3rd Appellate District. Decided June 23, 1937.

Silicosis; Mine Shut Down; Employee Refused on Reopening; Employee-Employer Relationship; Time of Injury. (Wisconsin)—An action by the Adanah Iron Co. against Prusi and the Industrial Commission to review an award. The circuit court confirmed the award. Prusi began to work for the plaintiff in 1926 and continued to so work until April, 1933, when the mine was temporarily closed down. He was put on "company relief", which permitted him to purchase groceries and supplies on credit with the understanding that when the mine reopened, he would repay the plaintiff. On November 29, 1933, he was refused work because of his ill health.

It was held that there is no testimony which supports the conclusion that the relationship of the employer and employee was terminated on April 25, 1933. The relationship continued until November 29, 1933, when the applicant was examined and denied work because of his physical condition. There is likewise no justification in the evidence for the conclusion of the examiners that in 1930 the applicant suffered a wage loss, when he laid off for two days, that was caused by an occupational disease. He was ill but two days. He had a cough with pains in his chest accompanied by a temperature not so high as that experienced by him in 1927 because of a similar illness. The doctor who prescribed for him at the time diagnosed his illness as a cold or cough. The commission was warranted in stating that at the time of the hearing the applicant was suffering from tuberculosis superimposed upon silicosis, an occupational disease, and that the applicant has been wholly disabled and incapable of performing work since September, 1933. The examiners could have awarded compensation pursuant to the provisions of Chapter 314, Laws of 1933.

The examiners should not have based their award upon the wages earned by the applicant in either 1929 or 1930, when the mine was operating on full time, but should have based the award upon the applicant's average annual earning capacity at the time of injury and in the employment in which he was then engaged, pursuant to Sec. 102.11. Judgment reversed and cause remanded for further proceedings.—*Odanah Iron Co. v. Industrial Commission et al.* Wisconsin Supreme Court. Decided October 12, 1937.

Silicosis; Right of Employee to Maintain Common-Law Action. (Pennsylvania)—An action alleging that the plaintiff contracted the occupational disease of silicosis as a result of inhaling, while in the grinding department of the defendant's plant, a quantity of steel, ascoloy and carborundum dust. The jury returned a verdict for the plaintiff for $6,000. The defendant's motion for a new trial was granted. The defendant appealed from the refusal of its motion for judgment n.o.v. The basic "question involved" is: "Where there is nothing in the pleadings or in the evidence to remove either party from the provisions of the Workmen's Compensation Act of 1915, P.L. 736, is not the action barred by the employee's voluntary and contractual surrender of his right to any form or amount of compensation or damages for any injury or death occurring in the course of his employment other than as provided by Art. 3 or said act?"

Held that this question must be answered in the negative. All the numerous provisions of the Workmen's Compensation Act apply only to cases arising from accidents, and occupational diseases do not so arise. It is well settled in Pennsylvania that an employee has a common-law right of action against his employer for injuries caused by disease contracted by the employee in the course of his employment and due to the negligent conduct of the employer in violation of a statutory duty.

The court below granted a new trial, saying: "The conclusion is inescapable that the verdict was against the weight of the evidence". There is nothing in the record which would justify this court in disturbing this exercise of the court's discretion. Judgment affirmed.—*Billo v. Allegheny Steel Co.* Pennsylvania Supreme Court Western District. Decided November 12, 1937.

Death from Silicosis; Compensability; Whether Accidents Occurred. (Nebraska)—An appeal from the disallowance of a claim for compensation made by the widow of a deceased workman. Mandler, deceased, worked for the defendant as a sandblaster for about six years. The plaintiff alleges that the death of Mandler was caused by two accidents; the first when the nozzle came off the hose, and, second, by the breaking of a hose while sandblasting, and sand was forced into his nose, and alleges that such accidents were the proximate cause of his death.

Held that it is not shown that the alleged minor accidents accelerated, or aggravated, or changed in any way the slow, steady progress of an occupational disease. Such accidents can not be made the basis for a recovery under the Nebraska workmen's compensation law. Affirmed.—*Svoboda v. Mandler.* Nebraska Supreme Court. Decided October 29, 1937.

Discussion and Recommendations.—It has been found impracticable to make an analysis of all the details of the various state laws regarding compensation for disability resulting from dust diseases. It has been feasible, however, to emphasize certain important phases of the problem by the presentation of material from which the following conclusions may be developed:

1. The provisions in the different states regarding the kind of compensation coverage vary greatly. Some states have what is known as "blanket" coverage; others specifically name dust diseases in their schedules; others fall under neither of these headings but make certain provisions under certain circumstances; the largest group makes no statutory provisions for the coverage of disability resulting from dust diseases.

2. The operation of occupational-disease disability compensation provisions is greatly modified and influenced by the legislative provisions relating to the rights of election of the employer and the employee; these latter factors also have considerable bearing on the availability of common-law action and the retention or abolition of defenses in such actions. As in reference to the type of coverage, the laws here also present wide variations.

3. Codes are of considerable importance and should be investigated by the employer in each instance, because in some situations, or as special provision may require, they may have the effect of law. Where not having the effect of law, they are at least guides, and information should be acquired concerning them. Such standards not only have reference to the regulation of the industrial environment, but also apply to methods of protection, such as systems of ventilation and personal devices to be worn by the employees.

4. Compensation-claims experiences reflect the types of cases which have been brought before commissions for adjudication and demonstrate in a general way what may be expected in the future in regard to dust-disease claims.

5. Court decisions show what types of cases and what kinds of legal problems have been experienced, resulting from cases on appeal in most instances. These decisions form the background of common-law opinion and, therefore, are of considerable importance in demonstrating legal trends. Such material also forms the basis for the understanding of the judicial interpretation of statutory requirements, as well as a valuable appraisal of the evidence submitted in the original hearing.

Previous experiences seem to indicate that the employer has in most instances been more concerned with the nature and extent of his liability than he has with certain fundamentals which are present in all cases and must be considered in their adjudication. It seems basic that the following questions must be answered in every case before intelligent consideration can be given to the merits of the claim:

1. Do the working conditions under which the employee labored present an actual occupational-disease hazard?

2. Has the employee a real occupational disease as he claims?

3. Was the occupational disease in question contracted while working for the employer against whom the claim has been filed?

4. Is the employee disabled from the effects of the occupational disease which he alleges to have?

Although these are important elements and should be discussed and appraised in every instance, each case is different and must be considered upon its own merits. There is no formula, each problem presenting a different series of combinations and permutations of factors and circumstances.

An adequate definition for the term "occupational disease" is a conception of prime importance in these problems. Most definitions take into consideration the occupation or the environmental factors, and *then* not specifically, without attempting to make limited comments on the effects of such industrial environment. The author has previously defined occupational disease and although the definition is not the final word on the subject, it has been found acceptable by certain authorities: "An occupational disease is one which occurs with definite frequency and regularity in occupations where there is a specific exposure as the cause which operates to produce effects in the human body recognized clinically by the medical profession as pathological changes and effects produced by the specific exposure involved".

What tangible procedures are available to the employer to prepare himself for the contingencies which may arise? The answers to this question partake both of preventive methods and preparatory measures for the defense of claims:

1. Definite knowledge concerning dust exposure should be obtained with reference to all the occupations where such exposure exists, dismissing all fallacious assumptions and guesswork. This can be accomplished by the making of scientific dust surveys and studies. Where exposure conditions present a real disease hazard, it is clear that proper control measures should be instituted.

2. In instances where an employee files a claim, competent legal and medical advice should be used to determine whether the employee has a real occupational disease as alleged.

3. If it is determined that the employee has an occupational disease, it must then be decided, through adequate investigation based on dust surveys and studies, whether the claimant contracted the occupational disease while working for the defendant employer.

4. Finally, the proper application of adequate medical consultations should provide the decision as to whether the employee is actually disabled from the effects of the occupational disease which is proved to exist.

It is necessary to emphasize that the whole approach on this subject should result in information which shows distinct cause-and-effect relationships in order to establish clearly the responsibility of the employer. If the above-mentioned recommendations can be carried out, it can be safely asserted that the aspects of any given claim problem may assume an outlook entirely different from what has been generally experienced heretofore and, therefore, provide an intelligent approach and solution, rather than the chaotic and hysterical reaction which has so frequently been observed.

Wage and Hour (*from page 45*)

the aim of expediting the attainment of the 40 c. minimum prior to the expiration of the statutory limit. Such minimum wage rate could not exceed 40 c. and could not be less than 30 c.

The Act will be administered by a Wage and Hour Division to be created in the Department of Labor, which division will be under the direction of an Administrator to be appointed by the President.

Persons "wilfully" violating the law are subject upon conviction to fine of not more than $10,000, imprisonment for not more than 6 months, or both. The imprisonment penalty could not be inflicted for conviction of a first offense.

Persons "aggrieved" by an order of the Administrator may obtain a review of such order in the Circuit Court of Appeals of the United States, but judicial review is limited to questions of law and findings of fact by the Administrator, "when supported by substantial evidence," shall be conclusive.

Wyoming Vermiculite Co. Acquires 2,000 Acres

The Wyoming Vermiculite Co. recently began exploration work 12 miles southeast of Glenrock, Wyo., in Mormon Canyon, where it has acquired nearly 2,000 acres laden with vermiculite deposits. Three or four mines are to be opened in the near future.

LIME PRODUCTION PROBLEMS

BY W. R. CLIFFE

The Evolution of the Rotary Lime Kiln

AUTHORITIES on such matters tell us of the first known attempt with a rotary furnace about ninety years ago, when in 1848 an English engineer invented the great grandfather of the rotary kiln for the treatment of black ash. While this initial effort proved unsuccessful, we are not told whether the failure was due to poor design, insufficient funds, or a combination of the two. However, the idea was sound, because a few years later a similar installation went into successful operation. The "revolver" became quite popular and was used generally throughout the alkali works in England as well as in other countries. This, evidently, was the earliest form of rotary cylinder used for the treatment of materials while in motion by employing a flame or heated gases passing over the surface of the charge. These early machines worked on a batch principle, and as the charging and discharging of the "revolver" were intermittent, the ends were open only sufficiently to admit the heat and exhaust the exit gases.

In 1885 a patent was granted to Henry Mathey of New York on a process of making lime for commercial purposes by burning the rock in a rotary kiln. The method patented consisted "in first crushing the limestone to a suitable fineness, then burning the crushed or pulverized stone in a revolving cylinder, whereby the particles of stone were subjected to a consistent and uniform heat." Mathey proposed crushing the limestone to a size which would pass a 4- or 6-mesh screen and calcining it in his rotary kiln by means of heat derived from a grate fire. Without any intention of detracting from the value of Mathey's ideas we may suggest that it is possible he had been familiar with Crampton's patent of 1877 for burning Portland cement in a rotary kiln and also Surnan's mention of having used his rotary furnace for the burning of lime at an even earlier date.

Little is known of any attempts to experiment with the new device in a commercial way until the close of the century, when the California Portland Cement Co., along with some other operators in the cement region of Pennsylvania, proved beyond a doubt that lime could be produced for commercial purposes in rotary kilns. In 1906 at Carthage, N. Y., the New York Lime Co. erected a 6-ft. by 100-ft. rotary kiln for the burning of lime for commercial purposes. The kiln was fired with producer gas, and much grief was experienced. However, the company persevered, and ultimately succeeded in overcoming the many difficulties.

The Charles Warner Co. of Wilmington, Dela., was one of the first to recognize the possibilities of the rotary kiln, and in this, as in many features of modern lime practice, this progressive group, under the direction of Irving Warner, pioneered for the industry. In the early 1920's a 9-ft. by 175-ft. kiln was erected for the American Lime & Stone Co. of Bellefonte, Pa. This unit was originally conceived as a wet-process kiln but was never utilized as such. However, during this same period a number of kilns of approximately the same size went into operation, and it is from them that we have developed the modern unit.

During the infancy of the rotary kiln in the lime industry the kiln manufacturers were not without precedent and had much of the experience of the cement industry from which to draw. The earliest rotaries used in the cement industry were 4 ft. in diameter and 40 ft. long, and they were considered enormous pieces of equipment. Later, as engineers became more daring, the diameter was increased to 6 ft. and the length to 60 ft.

Some of these kilns actually carried three tires. The tires were rectangular in section and made of welded steel. They were supported on a number of small cast-iron blocks bridged across under the tires with a light bar, the thought in this case being that an allowance should be made for expansion between the shell and the tire. The net result of this design was that the cross bars or bridges heated sufficiently to lose their strength, and eventually the tire became eccentric to the shell, and, of course, loose.

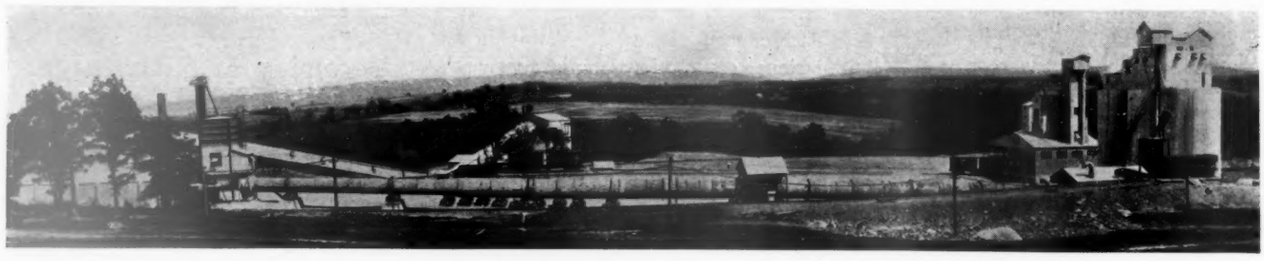
The girth gear was fastened to the shell by means of the chain arrangement in the first kilns, but operators later came to the use of leaf-spring design, which was standard for quite a number of years.

The supporting bearings were nothing more than pedestals of crude design set on very thick cast-iron bed plates and carrying chilled cast-iron rollers, which were keyed to or shrunk on ordinary steel shafts. The bearings naturally were babbitted at the beginning, but later were bronze-bushed, grease-lubricated in both cases.

The driving mechanism was an open train of gears and pinions. Many kilns of this type are still in existence.

The Vulcan Iron Works was the first company to use the cast-steel tire of the design still in wide use to-day. There, of course, was the transition from the first solidly-riveted tires of cast steel to the newer design, and the later efforts of all manufacturers to make a rivetless tire that would be successful in operation. The full-floating tire resulted, but, in many cases, it "floated" to such an extent that wear followed, so that corrective steps had to be taken to control its movement.

The bearings gradually developed



The world's largest rotary lime kiln, 400 ft. long, at the plant of the Chemical Lime Co., Bellefonte, Pa.

from the single roller type to the double rocker or cradle type, principally because of the fact that kilns increased in size, so that it became impractical to use single bearings. Now, the trend is reversing itself, single bearings being preferred in the latest installations. Chief among the reasons making single bearings practical is improved lubrication.

The distance between supports has always been more or less what it is today, except that originally the overhang on both ends of the kiln was the same but later developed to a short overhang at the discharge end. A shorter overhang at the discharge end than at the feed end was made only because of the desire to equalize the loads on the supports.

It was the practice to line the kilns with 9 in. of brick through the burning zone, thinning down to 6 in. for the remainder.

Much effort was expended to avoid having the discharge-end tire in the hottest zone, and this has resulted in multiple-tire kilns. The development came with the improved economy made possible through the use of longer kilns.

Great progress has been made in sealing rings. Originally considered of secondary importance, they are to-day of paramount importance. Three methods of approach to a positive seal are used:

1. Where a steel circle is placed as close as possible to the kiln shell, restricting the opening.

2. A design wherein one stationary member slides in between the two other members attached to the shell.

3. The rubbing type, wherein two wearing surfaces rub together, which, after all, is the nearest we can come to an absolutely tight seal.

There are many variations to these designs but they invariably fall within the three basic principles named. It is another instance of overlooking first cost for the purpose of obtaining efficiency at a low maintenance figure.

To most operators the shell typifies the kiln, and the tires, driving mechanism, thrust rollers, bearings, lubrication, etc., are all of secondary importance. However, by exercising greater care in the selection of these items the difficulties, which often beset the shell or kiln proper, would be minimized.

Manufacturers have for years used ample safety factors in the design of riveted joints, but almost invariably trouble arising in operation starts with the rivet or rivet hole. It is almost impossible to foresee the terrific stresses to which a kiln shell will be subjected during its life, but even with a knowledge of thin linings, excessive temperatures on one side of the shell, hot spots, power failures with no stand-by unit, torrential rains on exposed shells, prolonged shell temperatures of 600 to 800 deg. F., and innumerable other abuses, caused by a shortage of lime or poor supervision, there is little the fabricator could do beyond orthodox design and good workmanship in his shop. Several of the more conservative manufacturers cling to the riveted shell, but welded units have now been in service for a sufficient period of time to receive the stamp of full approval, having successfully demonstrated their ability to do more than hold their own, when exposed to all the abuses known to their riveted predecessors.

The quality of the welds produced to-day by the modern shielded-arc process of electric welding is indicated by the fact that, in the matter of physical properties, the welds so made are equal to, or better than, the steel welded. Welds made by the shielded-arc process possess a tensile strength of 65,000 to 75,000 lb. per sq. in. compared with 55,000 to 65,000 lb. per sq. in. for mild rolled steel. In ductility shielded-arc weld metal equals steel, the figure being 20 to 30 per cent. elongation in 2 in. The same is true of density: the weld metal has a density of from 7.84 to 7.86 g. per c. c. compared with 7.86 g. per c. c. for steel. In fatigue resistance the weld metal is actually better than mild rolled steel, 28,000 to 32,000 lb. per sq. in. compared with 28,000 lb. per sq. in. In impact resistance the weld metal is 50 to 80 ft.-lb. (Izod), while steel is 40 to 80 ft.-lb. (Izod). In resistance to corrosion the weld metal is actually superior to mild rolled steel.

The high-quality welds produced by the shielded-arc process are due to the exclusion of oxides and nitrides from the metal. The welding electrode, as it is consumed in the arc, produces an inert gas which envelops the arc and molten metal, thus preventing contact with the surrounding atmosphere. Since there is no opportunity for the molten metal to unite with the oxygen and nitrogen of the air, no oxides or nitrides are formed in the weld.

The effect of this "shielding" of the arc on the quality of the metal is readily appreciated by comparing shielded-arc weld metal with that produced with bare electrodes. For instance, compare these qualities of welds made with bare electrodes with those given above for the shielded-arc process: tensile strength 40,000 to 55,000 lb. per. sq. in.; ductility 5 to 10 per cent. elongation in 2 in.; density 7.5 to 7.7 g. per c. c.; fatigue resistance 12,000 to 15,000 lb. per sq. in.; impact resistance 8 to 15 ft.-lb. (Izod). Thus, it can be seen that the quality of welds produced today with modern equipment is very high.

While providing such high quality, electric-arc welding is inherently economical. It is acknowledged to be the simplest process known for joining metals. It connects the component parts of a structure directly together without the use of intermediate connecting members. This simplicity is reflected in simplified designing, reduced detailing, elimination of punching and drilling, and reduced handling. The net result of this simplicity and elimination of extra connecting members (which saves material) is a large cost saving.

The advantages of electric welding are well known in the pit and quarry field. An example of this is the fact that the world's largest rotary lime kiln completed last year at the plant of the Chemical Lime Co. in Bellefonte, Pa., was built entirely of electrically-welded steel. This kiln is 400 ft. in length. It consists of a 300-ft. zone, a 10-ft. tapered zone, and a 90-ft. preheating zone. It has a capacity of 200 tons of lime per day. The diameter of the kiln through the 300-ft. zone is 8½ ft. and through the preheating zone it is 7 ft. The temperature of operation varies between 400 deg. F. at one end and 2,100 deg. F. at the other. The kiln is fabricated of ⅞-in. steel plate throughout, except under the tires, where the thickness is 1 in. The construction is all arc-welded, there being a total of 21 arc-welded sections. The kiln was manufactured by the Traylor Engineering & Mfg. Co.

This type of rotary lime kiln demonstrates very clearly the advantages of arc-welded construction. The fact that the welds have physical properties equal to those of the steel of which the kiln is built gives it the required strength and rigidity. Moreover, the welded joints connecting the various sections of the kiln are absolutely leakproof. Also important is the ductility of the welded joints. Since the weld metal has an elongation equaling that of the plate metal, the structure can "stretch" uniformly. With temperatures of 400 deg. F. at one end and 2,100 deg. F. at the other this uniformity is important. The ductility of the welded joints prevents any concentration of stresses as might be the case in riveted construction. Another very important consideration is the fact that the joints will never work loose. The structure is virtually one single piece of steel.

There can be no question as to the strength of welded joints when they are made with proper equipment and in accordance with correct procedure. The equipment to be used should be decided on the recommendations of reliable arc-welding generator and electrode manufacturers. Definite pro-

cedures have been established for various types of work and these are also available.

The fact that the quality of the welds can be anticipated, knowing that the proper equipment is being used and correct procedure followed, makes it unnecessary in a great many applications to do any testing of welds. However, there occasionally occur instances in which testing of welds is desirable.

There are several methods of weld inspection. The simplest and most expedient is visual inspection. This requires only keen perception and experience in the use of proper weld procedure. Visual inspection gives clues to the inspector as to the procedure followed and will indicate any changes necessary in it.

Inspection during welding is also employed. Welding is probably the only process of joining metals where this is true. When inspection is made during welding four items are observed. These are: (1) the burn-off of the electrode; (2) the fusion, penetration and crater; (3) the formation of the bead; and (4) the sound of the arc. These signs will indicate to the operator or observer whether or not the proper procedure is being used, or if not, just what conditions should be modified to obtain the desired or necessary result.

Inspection is also carried on following welding. In this case also considerable information will be revealed to a qualified inspector. This information will include: the size and shape of the bead, the general appearance of the bead, the undercut, the overlap, the location of the crater, etc.

It is possible by means of a stethoscope to determine the quality of a weld by the sound produced when a hammer strikes the weld in the immediate vicinity of a fault. The effective use of a stethoscope requires a high order of perception of sound quality.

Another method of weld inspection is the electro-magnetic. This method is based on the fact that if a magnetic flux is passed through the weld and adjacent base metal with the lines of flux approximately at right angles to the weld, there will be more leakage flux directly over the faults than at good portions of the weld. The faults can be detected either by sifting iron filings or iron powder on a piece of paper placed on the weld and observing the picture formed, or by exploring with an instrument capable of reading the strength of the leakage flux. An additional variation is to sift the powder direct on to the metal being tested. This gives greater sensitivity and reaches deeper into the weld being tested.

Weld metals can be X-rayed and their internal defects made clearly visible on photographic plates. If within a weld there are cracks, holes or general porosity, the X-ray photograph will reveal the condition. The method is simple. It consists of placing an X-ray tube on one side of the weld and the photographic plate on the other. After proper exposure, depending upon the thickness of the material, the strength of the X-ray, the plate is developed and examined for defects in the weld. This method is widely used as final inspection of pressure vessels which come under U-68 of the A.S.M.E. Boiler Codes.

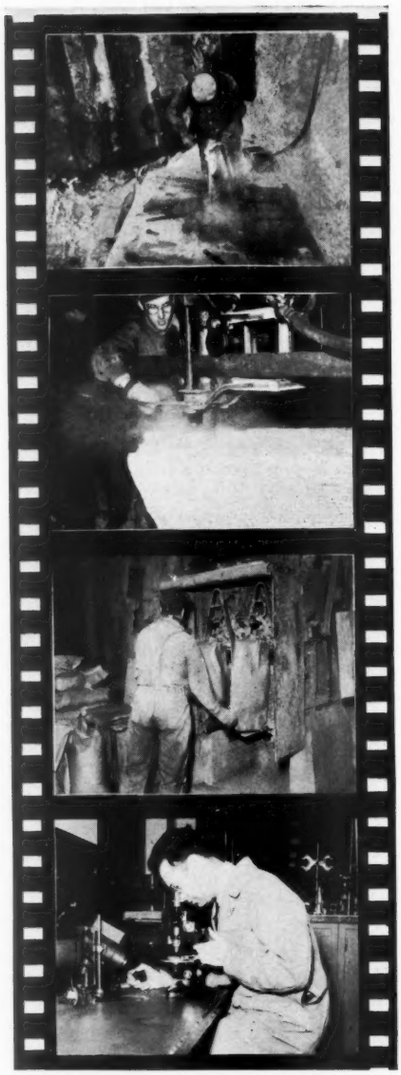
A method this is newer but simi'ar to X-ray inspection is inspection by Gamma rays. The Gamma ray emanates from radium. This ray penetrates the weld more quickly than the X-ray and is therefore used for inspecting heavy work which would require impracticably long X-ray exposures or for speeding up inspection on ordinary material.

Also of great importance to the operator is the placement of the refractory lining on the smooth surface of the welded shell. The savings accruing can be divided into two classes: First, in the actual process of laying the bricks. An interesting instance is recalled. A new lining was to be placed in a new welded kiln. Desiring to unload the blocks direct from railroad cars to the masons working in the kiln, in order to save the cost of several rehandlings, a shipping schedule, based on previous experience in placing a similar lining in the same size riveted kiln with the same masons, was given to the manufacturers of the brick. After the first car had arrived it became necessary to alter the entire shipping schedule, because it was found that the blocks went into place at more than double the rate of speed. This in itself constitutes a susbtantial reduction in the cost of placing the lining.

Second, the same type of lining, placed with the even support of the welded shell, and later operated under practically identical conditions, saw approximately twice as many months of service in the hot zone as had regularly been obtained from the linings placed on the rivets. This is a major item well worth the consideration of lime executives.

To the operator the welded shell presents many small advantages too numerous for mention here, but, if new rotary kiln equipment is under consideration, no fear of the welded shell should be entertained. Be sure of your fabricator. Then go ahead.

[Many of the data contained herein have been supplied by W. S. Dickie, engineer in charge, Cement, Lime, and Chemical Equipment of the Vulcan Iron Works, Wilkes Barre, Pa., and A. F. Davis, vice-president, Lincoln Electric Co., Cleveland, O. The writer acknowledges with thanks their contributions.]



Typical scenes from the motion picture "Stop Silicosis" are pictured above. The film, produced by the U. S. Department of Labor, Washington, D. C., with sound effects and narration, is available for showing to interested groups free of charge. Prints in both 16-mm. and 35-mm. sizes may be obtained. Requests for booking should be addressed direct to Washington.

Fuel Efficiency in Cement Manufacture

"Fuel Efficiency in Cement Manufacture, 1909-1935" has been prepared as a National Research Project of the Works Progress Administration in coöperation with the U. S. Bureau of Mines. The report points out that the average consumption of energy at American cement plants declined from 189 lb. of coal or coal equivalent per barrel of cement in 1914 to 159 lb. in 1935. Continued progress of fuel efficiency in cement manufacture is expected, according to the report, as new improvements are adopted and as equipment already successfully applied is more extensively introduced.

Personal Mention

ALBERT J. O'CONNOR has been appointed a vice-president of the Koenig Coal & Supply Co., Detroit, Mich.

WILLIAM J. KUNTZ, president of the Lime & Hydrates Plants Co., York, Pa., sailed from Los Angeles July 7 on the *S. S. Lurline* bound for Honolulu where he will supervise the installation of lime-plant machinery. He was accompanied by Mrs. Kuntz and expects to be away about three months.

D. A. MOULTON, formerly instructor in ceramics at Iowa State College, has become associated with Lancaster Iron Works, Lancaster, Pa., as sales and service engineer. His headquarters will be in Pittsburgh.

EINAR CHRISTENSEN, lightweight-concrete engineer and authority, has been appointed sales engineer for the new Pottsco department of The Celotex Corp. He will be located in New York, N. Y., and will work largely throughout eastern United States.

RALPH LOWRY, who, since 1935, has served the U. S. Bureau of Reclamation as director and construction engineer of the Boulder Canyon project (Boulder Dam) has been transferred to the Bureau's Central Valley project in California to become construction engineer of the New Shasta Dam.

CHARLES V. ALLEN, treasurer of the Westinghouse International Co. since 1925, has retired after 45 years' continuous service with Westinghouse.

DR. H. A. CURTIS, chief chemist of TVA has announced that the TVA will probably begin construction of a $500,000 phosphate plant near Franklin, Tenn., late this summer. It is now constructing a railroad to Franklin.

AL MOSCRIP, formerly with Moulding Brownell Co., Chicago, and the France Stone Co., Toledo, is now connected with the Construction Aggregates Co., Ferrysburg, Mich.

JOSEPH WINKE of Cedar Rapids, Ia., recently opened a quarry and plant near Bonaparte, Ia., to produce both commercial and agricultural limestone.

HARRY B. MELLER has been awarded the honorary degree of doctor of science from the University of Toledo. Dr. Meller is managing director of Air Hygiene Foundation, an organization for the advancement of industrial health. He has been in charge of air hygiene research for twenty years.

A. B. RAWN, of the Wilson Sand & Gravel Co., Huntington, W. Va., has been elected president of the Huntington Manufacturers Club.

MILTON E. CROSBY has been made general manager of the Burrell Engineering & Construction Co., Chicago, Ill., succeeding JOSEPH WILSON, 53, who died June 28 of heart failure.

WILLIAM J. DALY, formerly Detroit district sales manager for Worthington Pump & Machinery Corp., has been transferred to the Philadelphia office as manager to succeed C. H. Shaw, deceased.

JOHN G. KONEN, 57, president of the Lenahans & Konen Gravel & Construction Co., Vincennes, Ind., died of a heart attack recently, shortly after returning to his home from an automobile ride.

JOSEPH YIKE, who had been connected with the Southwestern Portland Cement Co. for a number of years, died July 8 at Osborn, O. He is survived by three sons in the cement industry; D. W. Yike, Volunteer Portland Cement Co.; Joseph S. Yike, Great Lakes Portland Cement Co.; and Carl Yike, with Southwestern.

GORDON RAYMOND, formerly head of the Raymond Concrete Pile Co., Detroit, Mich., died recently at Pasadena, Cal., following an illness of near'y two years.

JAMES GREEN, 35, an employe of the Campbell Limestone Co., Gaffney, S. C., was accidentally electrocuted when he came into contact with a 110-volt wire during blasting operations at the quarry. He was standing in a shallow pool of water at the time of the accident.

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Foreign Developments

Effect of Gypsum on Cement Properties

The question of how much the setting time of cement at 30 deg. C. is affected by the different varieties of gypsum and the quantity of the admixture has never yet been explained. This investigation has recently been required in connection with the paving of the German highway system in the summer months. Although the remarkable behavior of some cements in setting tests at 30 deg. is probably to be ascribed to the alumina modulus, it was not out of the question that the form of calcium sulfate and the amount of the admixture might play a certain part in the alteration of the setting time at high temperature, as is the case in the regulation of the setting time in ordinary conditions. Of further interest was the effect of the kind of gypsum and the amount of admixture on strength and shrinkage in the working of cement in plastic mortar; this question also has not been adequately explained.

A series of investigations reported in this article indicated that the setting time of cements of the present type, at 30 deg., is not abnormally changed by the three varieties of calcium sulfate: double hydrate, hemihydrate and natural anhydrite. Increased admixture of gypsum (to 4 per cent.), as is generally recognized, has a favorable effect on the development of strength. The swelling of plastic mortar in water storage is not particularly affected by increased additions of gypsum. On the other hand, the standard tests showed small fissures at admixtures of 6 per cent. In general, therefore, the standard limit of 2.5 per cent. for the SO_3 content can only be exceeded with extreme care. With increasing admixtures of gypsum the shrinkage of the mortar prisms decreases.—G. Mussgnug in *Zement* 27:303-307, May 19, 1938.

Mixed Crystals in Cement Clinker

In a further study on the problem of the constitution of Portland cement, a Portland-cement clinker very high in alumina was produced, partly as in actual practice. The portion of the clinker dust passing through the 10,000-mesh per sq. cm. sieve was divided in a centrifuge into seven fractions and investigated by chemical and X-ray methods.

The chemical analysis and the clinker-mineral composition computed therefrom according to Bogue's method show that the lighter portions of the clinker contain in addition to $3CaO.SiO_2$ a considerable amount of $3CaO.Al_2O_3$ and with increasing specific gravity the quantity of $2CaO.SiO_2$ increases. These results correspond very well with the roentgenographic identification. There was an exception, however, that in the heaviest fraction, in which according to the calculation according to Bogue there should be contained no $3CaO.SiO_2$, a considerable quantity of it was found by the X-ray investigation.

By most careful evaluation of the roentgenogram of the $3CaO.Al_2O_3$ in the cement clinker in comparison with pure tricalcium aluminate, there was found in the former a slight shrinkage of the crustalline network, and in order to explain this shrinkage of structure two series of fusing tests were conducted in the system $3CaO.Al_2O_3$-$4CaO.Al_2O_3.Fe_2O_3$ and $3CaO.Al_2O_3$-$3CaO.SiO_2$.

The system $3CaO.Al_2O_3$-$4CaO.Al_2Fe_2O_3$ showed mixed crystal formation, but in connection with it is was also possible to recognize an expansion of the crystalline network, quite the contrary of the $3CaO.Al_2O_3$ in cement clinker. In the system $3CaO.Al_2O_3$-$3CaO.SiO_2$ a mixed crystal formation running parallel took place with increasing admixture of $3CaO.SiO_2$, and the constants at maximum shrinkage of the network agree nicely with that of the $3CaO.Al_2O_3$ in the cement clinker. From this it was recognized that the tricalcium silicate in high-alumina Portland cement is not present as a free-calcium aluminate, but takes up small quantities of $3CaO.SiO_2$ along with the formation of mixed crystals. It is also very probable that in Portland cement of normal composition, in which the content of alumina is not so high, the opposite is the case, *i.e.*, that $3CaO.Al_2O_3$ is taken up by the $3CaO.SiO_2$ along with the formation of mixed crystals.—Dr.-Ing. K. Koyanagi, S. Katoh and T. Sudoh in *Zement* 27:363-367, June 16, 1938.

"Granulograph" for Aggregate Proportions

When concrete is mixed without control, water is added until the concrete appears plastic enough; the worse the composition in ratio of sand to gravel is, the greater is the quantity of water required, with consequently lowered strength of the resulting concrete. On this account, comparatively poor concretes are sometimes produced as a consequence of poor proportions of the aggregates and through no fault in the cement. The practical problem is, therefore: given several aggregates to mix, and a determined proportion of cement, to find the proportions in which the aggregates should be mixed so as to require a minimum of gauging water.

This operation, after determining the proportions passing the various sieve sizes, can be numerical or graphical. In spite of its simplicity, it is exacting. On that account there has been developed at the Bureau Securitas a device called the granulograph which solves the problem mechanically. When the composition of each aggregate and its proportion in the mixture are known, the machine automatically traces the granulometric curve of the concrete, eliminating the necessity of calculations. In consequence of its continuous operation, it is possible to observe immediately the variations in the granulometric curve of a concrete when the proportions of the aggregates of which it is composed are varied.—M. Caquot and M. Faury in *Revue des Materiaux de Construction et de Travaux Publics*, No. 340, January, 1938, and No. 341, February, 1938, pp. 25-32.

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Traffic News Digest

Legislation

In a recent address before the New York railroad club, Representative Pettengill of Indiana spoke on the railroad problem, and outlined an eleven-point program working toward the solution of this problem. This speech is of special significance since the Representative is a member of the house committee on Interstate and Foreign commerce and introduced the Pettengill bill in the House for the repeal of the long and short haul clause of the 4th section. The program he has outlined will probably be considered by the House committee at the next session. In stressing the need for action in connection with this program he pointed out that during the first 5 months of 1938 every railroad serving the City of New York operated at a loss and that only 5 of the large railroad systems in the entire country operated at a profit. He further pointed out that one-third of the railroad mileage in the country was in receivership and another third was on the brink; that the nation's biggest industry was in the worst shape in a generation. In answering the contention that the railroads should be allowed to "go through the wringer" he said following the announcement of his eleven-point program:

"Someone must be found to invest between $20,000 and $25,000 of actual, not make-believe, dollars for every man employed in railroading. A good way to force the RFC to take over the railroads is to continue to demagogue about the 'coupon clipper.'

"The coupon clipper, in the last analysis, is an American citizen who worked and saved and put his savings in the railroads, often in the form of premiums on life insurance for his widow and kids. As direct and indirect railroad investors, there are 64,000,000 such 'coupon clippers' and it is time for them to get upon their hind legs and howl—and vote!

"This is but a partial program. None or all of these points would in themselves solve the railroad disease immediately in its present acute state. Emergency hypodermics may be necessary, such as temporary wage adjustments, public loans or relief expenditures for maintenance. But the mere adoption of this old-fashioned program of 'equal rights to all, special privileges to none' in my judgment would in itself revive the courage that built not only the roads but America. It would make the pulse beat in every vein and artery of the nation. It would do more than any possible pump priming, court packing or government reorganization, to rebuild our lost prosperity. If we clear the track for the Iron Horse, we set the signal for America."

Representative Pettengill calls his program "Equal Rights for All" and includes the following eleven points:

"1. Stop government competition. Sell the Federal Barge Line. If it is one-half as good as Major-General Ashburn says it is, buyers should be warned not to crowd.

"2. Stop subsidizing their competitors—at railroad expense. Stop taxing them to build highways or airports.

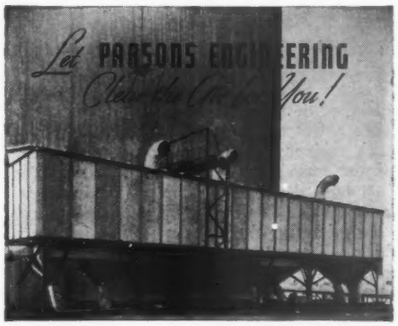
"3. Pass the Pettengill long-and-short-haul bill, already passed twice by the House by large majorities and now on the Senate calendar. The only argument against it is to keep the railroads in handcuffs for the benefit of their competitors. Apply the long-and-short-haul rule to all transportation agencies or none.

"4. When railroad facilities are required for the benefit of their competitors let the cost follow the benefit. This includes elimination of grade crossings for highway traffic, and bridges for waterway traffic. In the pending aeronautics bill it was proposed by the administration officials who wrote it to require the railroads, at terrific expense, to install and operate warning lights on their telegraph poles and other structures, for the benefit of aviation. This is a sample of what they are up against.

"5. Whatever may be done with foreign shipping, stop subsidizing intercoastal ships, as proposed in the merchant marine bill now in Congress.

"6. Don't pass the McAdoo bill to repeal tolls on American ships going through Panama Canal. Why charge private freight bills to the public?

"7. Put all freight, mail and passenger rate making for all carriers under one body—railroads, trucks, pipeline, coastwise, intercoastal, Great Lakes and river shipping and aviation—and make that body next in dignity, importance and independence to the Supreme Court. Present split-up of rate making among different government agencies is intolerable. The agencies compete with each other as well as the carriers.



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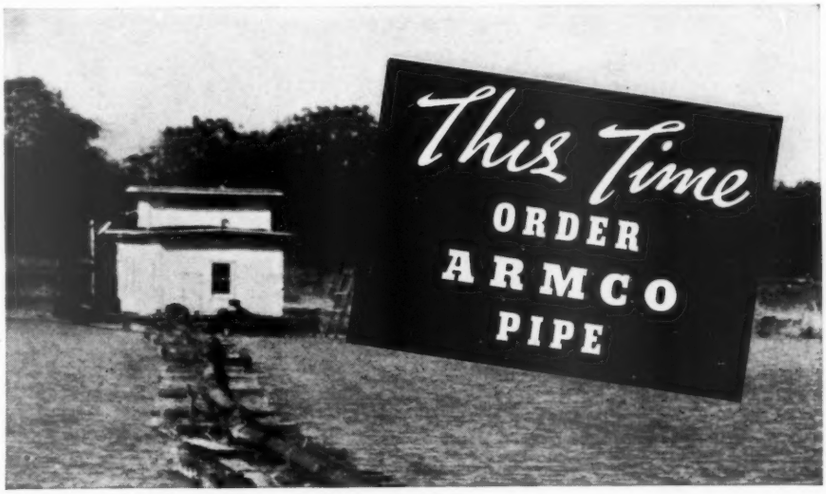

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"8. Restore railroad management to its constitutional freedom in strictly management problems. Whether government officials or private citizens manage the roads, the decision must still be made by human beings. There are some good men in Washington but no gods.

"9. An example of the foregoing is the problem of consolidation. Under existing law it is the duty of the I. C. C. to map out consolidation programs. This should be reversed. Let management work out such plans, leaving veto power in the I. C. C., as per the public interest, including preservation of railroad competition between large shipping and consuming centers.

"10. Repeal land-grant contracts except during time of war.

"11. Stop frightening investors with talk of repudiation of contracts in solvent roads. No doubt there are cases of over-capitalization. But this is not true of the railroads as a whole. They are clearly worth more than their outstanding stocks and bonds, and in No. 123 recently decided, the I. C. C. correctly stated that fixed charges are not a major factor in present difficulties. The per cent going to fixed charges is less now than in the days of their prosperity."

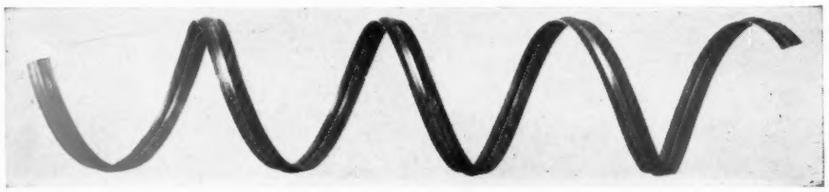
Recent I.C.C. Decisions

Cement—On the complaint of a cement manufacturer on Neville Island near Pittsburgh, Pa., the Pennsylvania commission prescribed rates on cement from Neville Island, P. & O. V. Junction and Universal, Pa., to destinations in the Pittsburgh metropolitan area which were on a lower level than the interstate rate applying in western Pennsylvania. After the new rates were established the cement traffic which had been hauled by truck returned to the railroads. On petition of the B. & O. and other railroads serving the Pittsburgh district the Interstate Commerce Commission instituted a proceeding on its own motion under the 13th section to determine whether the rates on cement c.l. minimum weight 50,000 lb. as required by the Pennsylvania Commission caused or would cause any undue or unreasonable advantage, preference or prejudice as between persons or localities in intrastate commerce on the one hand and interstate on the other; or any undue or unreasonable or unjust discrimination against interstate commerce. In the report written by Commissioner Porter, the Commission has found that the intrastate rates prescribed by the Pennsylvania Commission have not been shown to result in any violation of the law. Witnesses appearing at the hearing in opposition to the railroads said that if the rates were increased to the interstate level that they would be forced to resume trucking. Ohio cement makers appeared in favor of the increased rates. Commissioners Lee, Mahaffie and Miller dissented from the majority. I. C. C. Docket No. 27,768—Cement—Neville Island, P. & O. V. Junction and Universal, Pa., to Pittsburgh, Pa.

Truck Rates—That the Commission intends to call a halt to the general reduction in motor freight rates is evidenced by a recent decision covering proposed reduced rates between points in Illinois, Indiana, Ohio, Michigan, Wisconsin, Iowa, Kentucky, New York, Pennsylvania, and West Virginia which were suspended on complaint made by a group of the more important common carriers. At the hearing it was brought out that the tariffs of some common carriers when first filed on April 1, 1936, published rates on a lower basis than those which had been in effect prior to that date for fear that competing carriers might establish such low rates. Since that time carriers in central territory had progressively reduced rates to meet competition or below competitive rate levels in order to secure the traffic. Protestants contended that such reductions were made without due regard to the service and in this proceeding publishers of the reduced rates were required to produce evidence to show that the reduced rates complied with the law. According to the report only a few respondents attempted to present such evidences and the testimony was confined almost entirely with reference to the suspended items to a description of the proposed rates and the assertion that they were published to meet competition. Little evidence was introduced in an attempt to prove that the proposed charges would not result in unreasonably low rates and charges. In finding that the respondents had not justified the proposed rates the Commission ordered the suspended schedule cancelled. Statistics taken from the returns made to the Commission by Class I, Motor Common Carriers in central territory showed that in 1937 they operated at a loss of $434,832.94 and in the first 2 months of 1938 at an operating loss of $607,616,64. The report states that while rates were allegedly reduced to meet competition that no evidence was introduced with regard to the rates of competing carriers which were proposed to be met. I. C. C. Docket No. I&S No. M-278.

Examiner's Report

Examiner Horace W. Johnson recommends that the Commission find that the failure or refusal of defendants to establish commodity rates on dry building mortar from Linnville, Va., to destinations in southern territory on the same basis as now apply on building or structural lime in carloads from and to the same points be found not unreasonable or otherwise unlawful and that the Commission dismiss the complaint in I. C. C. Docket No. 27,880, Rockingham Chemical Lime Corp v. Southern Railway Co. et al.



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Occupational Diseases and the Law

Washington Law

In *Polson Logging Co. v. Kelly et al.,* decided June 8, 1938, 80 Pac. (2d) 412, the Supreme Court of Washington holds, sustaining a lower-court decision to the same effect, that the Washington occupational-diseases law of 1937 can not be constitutionally applied to an industry where employees are subject only to those diseases common to all employed people, and not to any of the *occupational* diseases named in the act. The constitutionality of the act was not otherwise passed upon.

The law involved is Chap. 212 of the Laws of 1937, adding a new section (Sec. 7679-1, Remington's Revised Statutes) to the Washington Workmen's Compensation Act, providing for the payment of compensation for disabilities sustained or death incurred by an employee resulting from occupational disease named in a schedule in the statute. [Silicosis is not specified, but the last paragraph in the schedule is "(21) And any persons employed in any industry where intense dust prevails."—Ed.]

"Occupational disease" has previously been defined by the Supreme Court of Washington, in *Seattle Can Co. v. Department of Labor and Industries,* 147 Wash. 303, 265 Pac. 739, as follows:

"As we understand it, an occupational disease is one which is due wholly to causes and conditions which are normal and constantly present and characteristic of the particular occupation; that is, those things which science and industry have not yet learned how to eliminate. Every worker in every plant of the same industry is alike constantly exposed to the danger of contracting a particular occupational disease."

To this the court now adds: "From the foregoing definition it is clear that before any disease may be classified in a legal sense as an occupational disease, it must be a disease, or diseased condition, which is peculiar to a given occupation and brought about by exposure to certain harmful conditions which are constantly present, and to which all workmen in the occupation are continually exposed".

The circumstance which brought about the present litigation was the action of the Department of Labor and Industries in ordering all employers of workmen in extra-hazardous occupations in the state to pay a premium of 1 mill per man-hr., and an additional 1 mill to be collected from every workman, into a fund established by the department as an Occupational-Disease Fund. Holding that there are no occupational diseases named in the statute to which the logging company's employees are or could be exposed on account of their occupation, the court rules that Chap. 212 does not apply to it, and the department is enjoined from requiring the company to pay any sums whatever under or by virtue of that law.

Silicosis; Partial Disability

Until 1935 New York had made no provision for a remedy in the Workmen's Compensation Law for the occupational disease known as silicosis. By Chapter 254 of the Laws of 1935 the New York legislature brought under the Workmen's Compensation Law "any and all occupational diseases". By Chapter 887 of the Laws of 1936 the legislature provided that compensation shall not be payable for partial disability due to silicosis or other dust disease, and made specific provisions for compensation in the event of temporary or permanent total disability or death from silicosis or other dust disease.

In DelBusto v. E. I. Dupont de Nemours & Co., Inc., decided June 6, 1938, in the New York Supreme Court Niagara County,* 167 Misc. 920, an employee sought recovery for partial disability from silicosis or dust disease on the grounds of: (1) alleged violations of the State Labor Law, (2) alleged violations of the rules of the State Industrial Board and of the Penal Law, Sec. 1275, and (3) alleged negligence on the part of the employer in violating the State Labor Law and the board's rules. It was alleged that the disability did not come within the purview of the Workmen's Compensation Law, since the disability was only partial.

The court agrees that partial disability from silicosis is not included in the Workmen's Compensation Law, but holds further that in removing partial disability from the coverage of the

* The Supreme Court in New York State is not the highest state court; appeals from its sessions in the various counties may be taken to an Appellate Division of the same court, and thence to the Court of Appeals.

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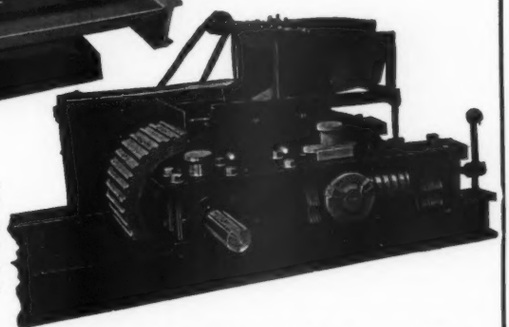

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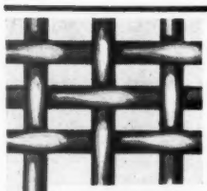
law the legislature did not restore to a sufferer therefrom a right of action at common law or under the Labor Law or Industrial Rules; the court "is of the opinion that after further study of the burden of the disease upon industry, the legislature decided that the employer should bear the burden of the effects of total disability and that the employee should bear the burden arising from partial disability".

In answer to the contention that the taking away of the common-law right of damages for partial disability, without providing another or different remedy, violated the constitutions of the United States (Fourteenth Amendment) and the state of New York (Art. 1, Sec. 6), the court points out that "since the 1913 amendment of the New York State Constitution (Art. 1, Sec. 19), the courts have consistently held that in providing for certain losses to the employee due to the injuries, diseases and dangers of his employment, which provision under certain conditions gave him an absolute right to compensation, the legislature could take from the employee certain other rights of action that he had at law, and that he had to bear the loss of those rights and be compensated therefor by the absolute right to payment under certain other conditions arising out of the same injuries, diseases and dangers". The court "is of the opinion that in enacting that portion of Sec. 66 of Art. 4-A of the Workmen's Compensation Law (Laws of 1936, Chap. 887) which provides 'Compensation shall not be payable for partial disability due to silicosis or other dust disease', the legislature determined that in compelling the employee to bear the burden of partial disability it was a burden that he should, in accordance with the constitution, be compelled to bear in return for the compensation allowed him for total disability or death from silicosis or other disease".

The Atlas Imperial Diesel Engine Co., Oakland, Cal., has recently opened a sales office in the Builders Exchange, at Chicago, Ill. F. H. Dickson, formerly manager of the Diesel division of Fairbanks, Morse & Co., is in charge.

The R&L Concrete Machinery Co., of Kendallville, Ind., has acquired from the insulated Natural Stone Co. of Milwaukee, Wis., the McKenzie patent which covers both the new stone-faced concrete unit backed with insulated concrete and method of manufacture described in the July issue of PIT AND QUARRY.

The company announces that it is prepared to furnish complete manufacturing equipment for the production of insulated natural stone and that they have perfected a low-cost vibration machine adaptable to make this product as well as a full line of conventional masonry units. The units can also be made with gang molds on the well-known R&L vibrating table which is used extensively in the manufacture of concrete joists and other specialty products.



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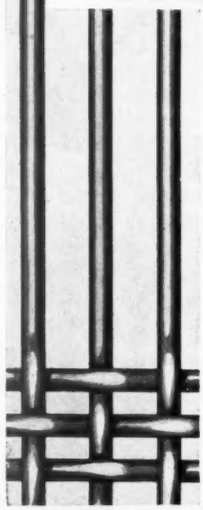

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• Particle Analyzer

The recent rapid expansion in general use of colloid mills and other fine-grinding apparatus emphasizes the fact that innumerable processes depend vitally upon accurate control of the size of particles. But now something beyond precision in factory control is necessary. Today's business competition brings new marketing problems, many of which may be solved by more accurate knowledge of particle sizes.

Particle sizer.

Particle sizes to 325 mesh —44 microns—may be determined by screen tests. Below 44 microns, however, other methods become necessary. And turbidimetric—photoelectric—and microscopic procedures have not been entirely satisfactory with respect to accuracy attained, initial cost and simplicity of manipulation.

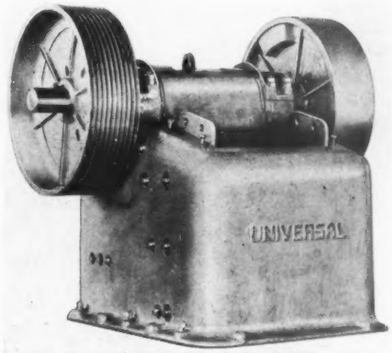
Based upon a modification of the Warner apparatus, the Colloid Equipment Co., New York, N. Y., has developed a sedimentation method of analyzing particle sizes below 44 microns which affords amazing accuracy of result as well as simplicity of design, speed and ease of manipulation and low first cost. Large samples are unnecessary, accurate results being obtained in about two hours from representative samples of less than five grams.

This new apparatus, known as the Palo-Travis particle sizer, operates on the principle that dispersed particles of dimensions exceeding the colloidal in a confined fluid medium tend to settle under force of gravity, and the rate of sedimentation proves the means of measuring particle size. It suffices, then, to measure accurately the rate of sedimentation.

The Palo-Travis particle sizer is designed for use in the hands of operatives in actual plant control. Its use can readily be mastered by an untrained person. Parts are easy to clean and can not get out of order. Further details may be obtained by writing the company.

• Jaw Crusher

Because the Universal No. 1016 "streamlined" jaw crusher introduced recently has met with such wide favor in the field, and to meet demands for a large "streamlined" crusher, the Universal Crusher Co., Cedar Rapids, Ia., has introduced the new No. 2436 "streamlined" Crusher with 24-in. by 36-in. feed opening.



New "streamlined" jaw crusher.

Like the No. 1016, this new crusher has a one-piece alloy-steel base with a smooth exterior, reinforcement being provided on the inside. This new "streamlined" base construction provides approximately 20 per cent. saving in weight which effects savings in fright and provides for greater portability.

The entire base is flush at the bottom providing a firm footing, the bolt holes being on the same centers as ordinary models to allow for ready interchangeability. Other features include the six heavy duty roller bearings, two on the pitman and two on each side, quick acting product size adjustment and wide feed opening. All major parts are made to be interchangeable with regular models of Universal 24-in. by 36-in. crushers.

• Pulverizer

The Allis-Chalmers Mfg. Co., of Milwaukee, Wis., for many years manufacturer of Pulverators (hammer mills) announces three new sizes of improved design to supplement its present line. The pulverizing chamber of these Pulverators are 24- 36- and 48-in. inside widths. They are designed to reduce the product of primary crushers handling moderately abrasive materials where small products with a maximum of fines are desirable. The pulverizing is by impact on involute liners, a principle which has been used for many years on this equipment.

Improved model of hammer-mill.

These new machines are of welded steel-plate construction, stress relieved, with wearing surfaces protected by rugged manganese-steel liners held in place by lugs on the liners extending through the frame and held securely with keys and setscrews on the outside. This method of securing liners means that there are

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Lang's Lay
•
Hemp Center
•
Wire Rope Center
•
Metallic Core
•
Seale-Filler Wire
Warrington

no bolt heads in the pulverizing chamber subject to wear. The machines are equipped with large anti-friction bearings; the rotor to which the hammers and arms attach is a series of heavy steel disks for flywheel effect. No external flywheels are required.

Another feature is the stirrup type of reversible and adjustable manganese-steel hammers with detachable manganese steel arms. This assures low replacement cost of these parts as generally one set of arms will outlast several sets of hammers. The grate bars are wear resisting steel and can be removed and replaced without disturbing the rotating element. The drive may be direct to electric motor or through Texrope V-belt, or flat belt.

ROADS whether mountain or farm to market under any condition

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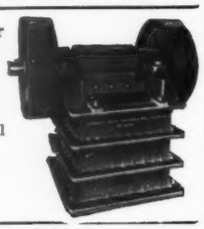
Bronze or Roller Bearing

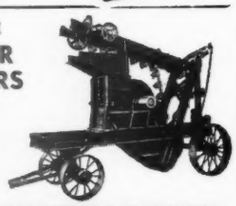
JAW CRUSHERS

Heavy plate steel or cast steel Constructed
Large capacity
Small power Requirements



PORTABLE HAMMER CRUSHERS

Ideal for farm to market road work. Crushes stone 1 inch down to agriculture dust.



GRUENDLER

CRUSHERS · PULVERIZERS · GRINDERS

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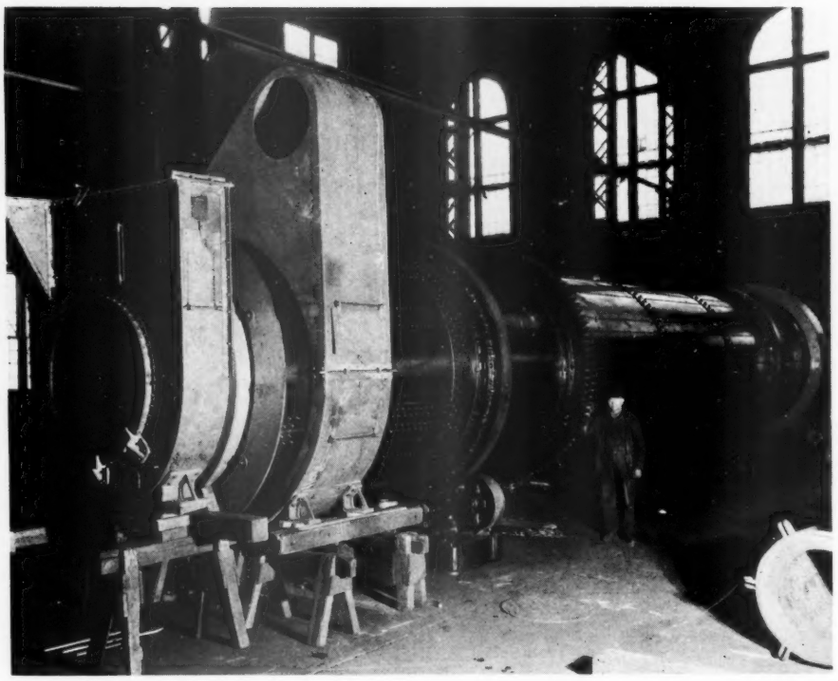
2915-21 N. Market St., St. Louis, Mo.



Dust-free operation is claimed for this new drier.

• Rotary Drier

A distinct and practical contribution to the art of drying certain chemicals, finely-divided clays, pumice, finely-divided silica and abrasives, with elimination of dust usually produced in the process, is the latest development in Ruggles-Coles driers, manufactured by Hardinge Co., Inc., York, Pa.

The Type "XB" Ruggles-Coles drier removes the moisture without necessity of installing elaborate and expensive dust-collecting equipment. These favorable results are obtained due to the design of the drier not allowing the gases of combustion, or large quantities of air, to come in contact with the material being dried.

This dustless operation is particularly advantageous where escape of dust would be an expensive loss, and, also, in the great number of cases where dust, from material being dried would be detrimental to the health and efficiency of the employees.

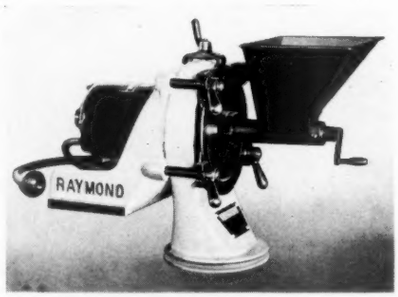
Cost comparisons made in a number of plants show that the installed cost of the Ruggles-Coles Type "XB" drier is considerably less than that of the conventional single shell drier, of equivalent capacity, plus the necessary dust collecting system required to control dust losses. Consequently, this type of drier has appealed to various plants upon which real economy in operation has been forced by present-day conditions.

• Laboratory Pulverizer

The Raymond Pulverizer Division of Combustion Engineering Co., Inc., Chicago, Ill., announces the development of a small hammer-type pulverizer for test-grinding operations in the production of powdered materials. It is a motor-driven unit, equipped with a hand-operated screw feeder and five different size perforated screens to give a wide range of classification of the product.

The material is reduced to required fineness by hammer action, thus producing the same character of product as made in large, commercial pulverizers.

The machine is ruggedly and compactly built, and can be easily taken apart for cleaning or changing screens. It is furnished with a cloth bag for filtering out the surplus air as the material is discharged to the metal container below the mill. A bulletin describing this mill will be supplied by the company on request.



Hammer-type laboratory mill.

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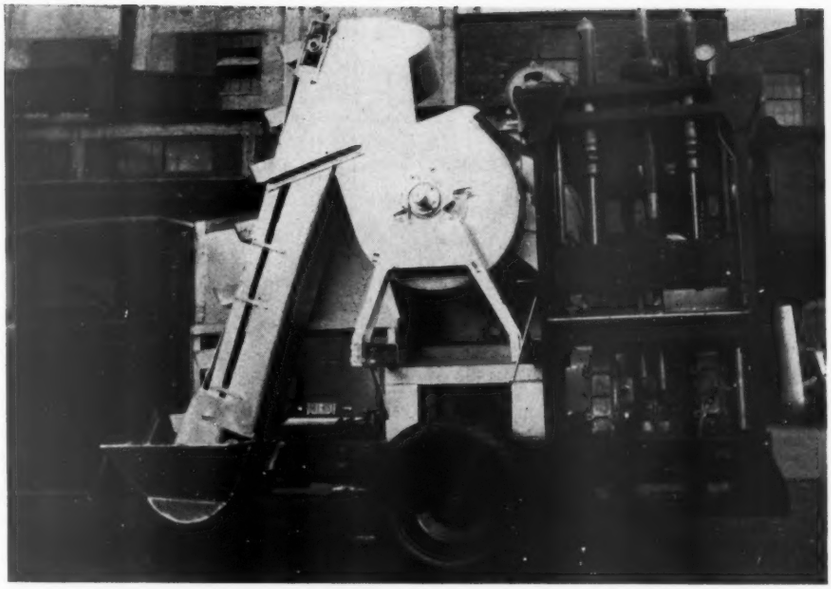
• Products Plant

A complete concrete-products plant, portable and in one machine, is being manufactured at the plant of the Concrete Transport Mixer Co., St. Louis, Mo., for the Fireproof Housing Corp., New York, N. Y., marketers of the Scudder System of double-wall construction.

Two machines for manufacturing the units are mounted on the frame, both operating from one motor and one mixer. The mixer is one of the regular Concrete Transport machines in wide use among ready-mixed-concrete producers. By this system, the Scudder units can be cast and stored on the job and a portable concrete-mixing plant is also available for all kinds of monolithic work. Concrete pipe and drain tile can also be turned out.

The Scudder System employs units which are nearly 70 per cent. air for insulating value and the maker claims that the resulting strength is as great as solid walls laid in ordinary mortar. The following three improvements are said to make this possible:

1. The production of specially-designed, strong 4-in. by 8-in. by 16-in. (and fractional) masonry units having round, horizontal voids full of arches, which in themselves have good insulating value, due to the absence of convection currents which occur in vertical voids.
2. Interlocking media which bring the shearing strength of the component material into action against movement in any direction.
3. And most important—the unique mortar joint of grout, only 1-16-in. thick, fully enclosed and waterproof, cements the units together inseparably.

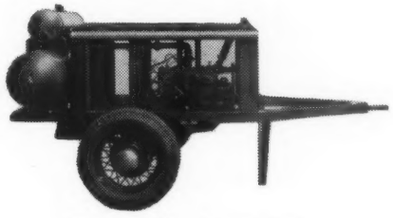


The portable products plant on truck mixer.

• Air Compressor

A small, portable air compressor employing a Ford 4-cyl. engine both for compressing the air and supplying the power is being marketed with considerable success by the Little Giant Air Compressor Mfg. Co., Kansas City, Mo.

In the Little Giant compressor, the two end cylinders are used for power, the two middle cylinders forming the compressor developing 60 lb. of free air per min.



The portable air compressor.

For use in connection with the compressor, the company recommends the Little Giant Model C-8 rock drill since the air consumption on the drill is only 46 cu. ft. of free air per min. at 80 lb. pressure and will handle holes to 20 ft. deep.

The concern also manufactures a larger compressor employing two Ford Model B engines.

• Automatic Drifter

The Sullivan automatic Adjust-O-Feed drifter is outstanding because of its ease of handling, its flexibility, and its low upkeep cost. It is said to be the only automatic drifter with an adjustable feed for efficient drilling in changeable rock. It uses a chain drive which does away with the expensive feed nut and feed screw replacements.

The design of the drive unit with its three major parts is such that more positive feeding is attained. An air-operated rotation release is used. This aids materially in collaring holes and in freeing stuck steels.

New drifter drill.

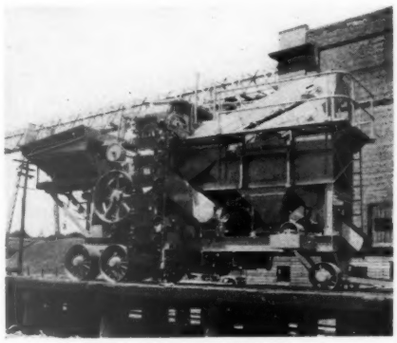
For complete information concerning these cost-cutting drifters, write the Sullivan Machinery Co., Claremont, N. H.

• Portable Plant

The accompanying illustration shows a Badger tandem double-unit No. 38 portable combination stone and gravel plant for shovel operation, loaded at the plant of the Wisconsin Fdry. & Machine Co., Madison, Wis., for shipment to an Illinois producer. This plant was designed for producing one size of material and eliminating fines at the same time.

The unit consists of a 9-in. by 36-in. Timken roller-bearing crusher, a 2-deck Selectro vibrating screen, a 24-in. belt feeder with 30 cu. ft. loading hopper, a 24-in. by 20-ft. plant conveyor to screen, a 24-in. by 20-ft. side-loading conveyor to trucks, and a pivoted, bucket-type elevator for returning crushed material for resizing. The unit is mounted on a truck with steel wheels because the unit is transported on long hauls with a trailer.

The material is loaded by means of a shovel into the loading hopper and conveyed by means of belt feeder and plant conveyor to a hopper which distributes it evenly over the head end of the screen. The material that does



Crushing-and-screening plant.

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not pass through the upper deck of the screen is broken to the proper size for secondary crushing. The material that passes the upper deck but not the lower deck of the Selectro screen passes down to a set of 30-in. by 16-in. rolls where it is broken up to the proper size for the size of material required.

The stone that is broken by the jaw crusher and rolls drops to the buckets of the pivot elevator which lifts the material back to the plant conveyor and finally through the screen for re-screening. After material passes through both decks of the screen, it consists of sizes from sand to the largest size of stone required. From the hopper below screen the finished, sized material is conveyed to trucks by means of a side-loading conveyor.

If sand is rejected, part of the lower sizing deck in screen is replaced with a sand screen. By means of a gate the amount of fines that are rejected can be regulated. The rejected fines are spouted to the front end of the truck from where they can be loaded into the truck by a separate sand conveyor.

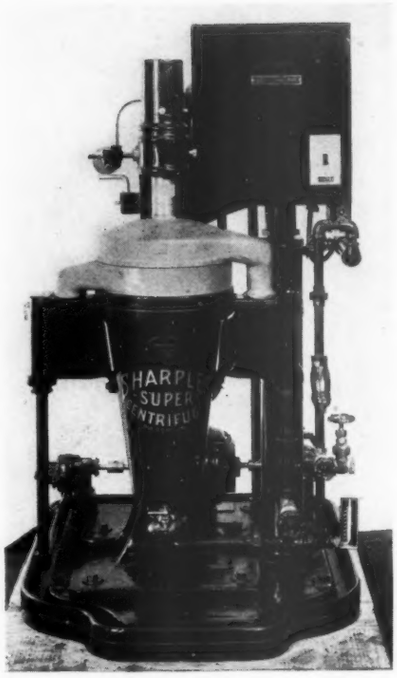
• Screw-Conveyor Flights

Calumet screw-conveyor flights made by the Screw Conveyor Corp., Hammond, Ind., are formed with more than one complete turn or lead, on the pipe, resulting in a recoil or gripping action, which insures perfect contact with the pipe throughout the entire conveyor section. This eliminates all possibility of the flights springing away from the pipe and leaving openings through which the material being conveyed might be forced, thereby retarding the flow and setting up strains which would weaken the conveyor.

The elimination of strains coupled with the fact that the long lead, tight-fitting flights are self-supporting is assurance that the rivet joints will never become loose under the vibration encountered during continuous operation. The perfect fit of flights on pipe, the extra long lead and vice-like grip or recoil resulting thereby, also reinforces the pipe and helps to maintain perfect straightness of the screw-conveyor section. The uniform and exact pitch or distance between spirals of the flights results in the screw conveyor feeding the material conveyed evenly the entire length of the installation.

As all flights are uniform in diameter the correct clearance between the screw conveyor and the box is maintained at all times.

The Screw Conveyor Corp., in addition to repair and replacement flights, also manufactures complete screw conveyors, frictionless end-thrust bearings, and the well-known Calumet, Hammond and Nu-Type elevator buckets.



Centrifuge for the purification and reclamation of oils, including Diesel-engine, fuel, crusher and miscellaneous lubricating oils. It is being manufactured by the Sharples Specialty Co., Philadelphia, Pa.

INCORPORATIONS

COLUMBIA MARBLE CO., INC., San Francisco, Cal. Capital $10,000. Incorporators: R. E. Tremoureaux, C. M. Cadman and Mortimer Fleishacker, Jr.

SOUTH MILWAUKEE SAND & GRAVEL CO., South Milwaukee, Wis. Incorporators: Fred Cheska, Robert Wayland and Agnes Flynn.

DENTON SAND CO., INC., New York, N. Y. (Queens). Freidland & Masone, 6819 Borden Ave.

PYRAMID CONCRETE PRODUCTS CO., Beaumont, Tex. Capital stock, $25,000. Incorporators: W. B. Landes, A. H. Hanna and L. I. Brents.

CONCRETE CO. OF TEXAS, San Antonio, Tex. Capital stock, $5,000. Incorporators: J. C. Ruby, A. B. Benyon and A. W. Loveland.

MAYSVILLE LIME & STONE CO., Maysville, Ky. Capital, $50,000. Incorporators: T. A. Duke, Harriet C. Duke and Andrew C. Duke.

MCHENRY COUNTY QUARRIES, INC., Marengo, Ill. 750 shares n.p.v. common stock. Incorporators: G. B. Huffman, H. Maselter and C. B. O'Connor.

MANUFACTURERS' NOTES

A new corporation, the Allied Tractor Equipment Co., has been formed with headquarters at Findlay, O. Richard A. Wheeler, former sales manager of Emsco's tractor-equipment division and Howard K. Biggs, also formerly connected with the same company, will be identified with this new organization. This organization will be the exclusive sales agents for the Tractor Equipment Division of the Emsco Derrick & Equipment Co., Los Angeles, Cal. In addition, the new organization will handle the sales in a number of territories of Buckeye Clipper shovels, material spreaders and road-widening machines, products of the Buckeye Traction Ditcher Co., Findlay, O.

The Steel and Tube Division of the Timken Roller Bearing Co. has appointed Joseph T. Ryerson & Son, Inc., to warehouse Timken mechanical tubing in territories served by Boston, Jersey City, Philadelphia, Buffalo, Cincinnati, Chicago, St. Louis, Cleveland, Detroit and Milwaukee.

Sprout Waldron Co., Muncy, Pa., announces the appointment of the Pittsburgh Gage & Supply Co., Pittsburgh, Pa., as exclusive distributor for its line of power-transmission appliances for the Pittsburgh area.

Consolidated Products Co. Inc., New York, N. Y., has purchased the complete manufacturing plant, machinery and equipment formerly owned by the J. B. Preston Co., manufacturer of roofing granules. Equipment, including crushers, vibrating screens, motor-driven hoists, rotary driers, etc., will be liquidated.

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AGGREGATE-BITUMINIZING PLANT OF THE BITUMINOUS PRODUCTS CORP., ERIE, PA.

By H. D. ROBARDS

Efficient Management Pulled This Pipe Firm Out of the Doldrums

JUST a year ago in June a new manager was put in charge of the John L. Zeidler Concrete Pipe Co. plant in Joplin, Mo., with orders to "make or break." The business had sunk to such a low volume level that it was virtually stagnant, and no profit was being made on the pipe sold. A program of plant improvement and sales improvement was instituted at once. And, in brief, the results of the changes were: An increase in business which carried through the remainder of 1937 and made the year show 400 per cent. more volume than 1936, with a consistent increase this year of more than double the rate of last year. Moreover, the pipe was sold at a profit which has enabled the improvement program in the plant to be carried forward step by step.

The new manager is Robert D. Moore. He had had just one year's experience with the company before he took charge of the plant. That was enough, however, for him to become acquainted with the plant's many comparative inefficiencies. For instance, it was requiring three men to feed the 2-bag Blystone mixer, and one man is doing that work to-day.

That was one factor which led to the first improvement being made in the plant; it typified a state of affairs which made profitable production impossible. A primary change was the substitution of individual V-belt drives on all machines, in place of a common driveshaft and belting which had been used previously. That also speeded up the work at the 2-bag mixer because the main drive belt had been running directly over it in such close proximity that the crew had to stoop under the belt in loading the mixer. By relocating the aggregate and concrete supplies so that the material flow was from the dock to level or slightly downgrade toward the mixer the improvement was sufficient to eliminate two of the mixing crew. And that was despite the fact that a four-beam aggregate scale was installed, together with a water scale, for making accurate and uniform mixtures, instead of making them by the old-fashioned "shovel-counting" method.

The 2-bag mixer feeds a chain conveyor running to the pipe-molding machine, which was designed and built by John L. Zeidler, founder of the company, fourteen years ago. There is another Blystone mixer, a 1-bag unit, similarly connected to a smaller Zeidler pipe machine. The aggregates are taken from lead-and-zinc mine tailing mills near the plant under a contract by which the mining company loads the pipe maker's concrete-aggregate bins. These tailings are mostly flint rock, suitable in size for the coarse aggregate as they are trucked in from the tailing piles. A Wise crusher is used to crush them to coarse and fine sands when reduction is necessary.

Supt. Leroy Roper and Robert D. Moore, the new general manager who made things hum at the Zeidler plant.

The two-bag mixer with rubber-tired wheelbarrow on loading dock at the rear.

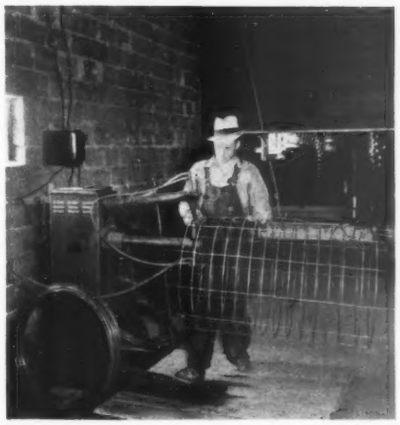
The installation of individual-drive motors for all the machines raised the company's connected horsepower to the extent that current consumption was increased. Yet the increased operating efficiency overcame that added expense, and the electric supply company is now working on a plan for reducing the current cost. Other improvements included concrete floors in the casting and curing rooms and some new roofing, with further improvements along those lines planned for the near future. A Canatsey 20-kv.-a. electric spot welder was installed so that a new practice could be instituted. That was the forming of reinforcing cores in the plant

shop. Naturally, a systematic reconditioning of all the machines was a part of the program.

The sum of those improvements was to put production on such a basis that pipe could be produced and sold at a profit. The next step was to get to selling pipe. That required overcoming some big obstacles. Since its establishment in 1914 the company had made nothing but sewer and common drain pipe. It had enjoyed some lean and some fat years while operating on that basis, and also had built up an experience in sales strategy that was useful.

The sale of two big sewer-pipe contracts had firmly established the company during those formative years. The first was in Joplin, home town of the plant, and it laid the basis for another sewer contract in the city. On that first one the company, in coöperation with Joplin city officials, began keeping careful record of the performance of the concrete sewer pipe, especially as compared to that of other pipe. The record-keeping proved the pipe's worth. As a result the city engineering department adopted concrete pipe for replacements when parts of older systems gave trouble.

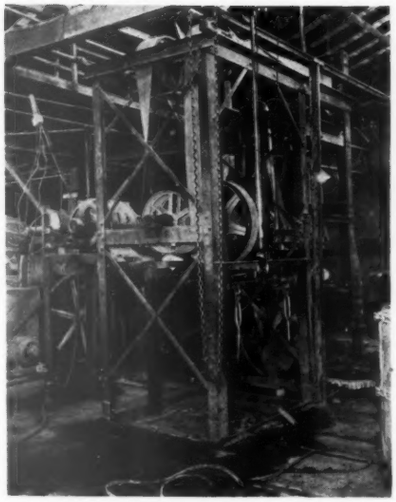
Four years ago another big sewer project was inaugurated in Joplin, with the price of the pipe figured at $22,000. This job was under the P.W.A., and



Forming reinforcing cores for large-sized concrete pipe with spot-welding equipment.

that added a great deal to the maneuvering necessary for Zeidler to get the contract, even with its record of pipe performance for its home town to back up its bid.

The first bid was accepted by the city, and everything looked smooth ahead, but because of a technical flaw in the manner of bidding, an entire new set of bids was ordered. This opened the way for competition to step in and give Zeidler a bitter price pill on its home grounds, because the figures had naturally become public property when the first bids were announced. That chance for difficulty was obviated when the



The Zeidler pipe machine. It is equipped with two unloading hoists, one for large and one for small pipe.

friendly city council passed a resolution demanding that the home products be used and that the Zeidler bid be allowed to stand.

But that resolution did not settle objections which were being made by the P.W.A. engineers. They were not familiar with concrete pipe in sewer work, and therefore specified that the concrete pipe, if allowed at all, be given an interior coating of asphaltic compound as a protection against acids. As that would have meant an added, prohibitive cost, the Zeidler officials immediately began an active campaign for proof of their product. A workman who helped in laying the original concrete-pipe sewer in Joplin was located. In the presence of a notary public and interested city officials he dug up a section of that first sewer pipe. Statements concerning his work in laying and removing the pipe after its continuous service for thirteen years were attested, the identity of the pipe was certified, and the company officials took their evidence to the state P.W.A. headquarters in St. Louis.

They impressed the P.W.A. engineers there to such an extent that the contract was approved, provided that an independent concern test the pipe as it was delivered on the project. This testing was done with equipment lent to a chemical laboratory by the pipe producer and the job progressed smoothly, with the pipe meeting all tests.

This rather sweeping performance was the culmination of years of sewer-pipe building which had established the company on a firm basis in that field. But the market for sewer pipe dwindled away after that year. So, when the order to "make or break" the company went out this year, it was necessary for a new market to be developed. And that was for road pipe.

Previously the company had made some road pipe. But its experience had not been happy, because of the manufacturing methods in use. The new manager found that the company's name was still respected, but that its pipe was not, as far as road building was concerned. So he started in to change that standing.

The states in which its markets lie were at that time working out the details of their specifications for road pipes, specifications which now accord in most details to those of the American Society for Testing Materials. Those states are Missouri, Arkansas, Oklahoma and Kansas, with the Zeidler company being located close to big road projects in each state. Their pipe specifications coincide so closely that different pipe does not have to be made for each state, so when the construction of pipe to meet these specifications was begun, the manager set about selling.

Things had reached the point where no salesmen could be employed, so he did the selling himself then, and is still at it. Contractors over a wide area were visited; the news that his company was building specification pipe was accepted as a basis for orders in a few instances. In others the proof of the pipe had to be given. But, within a comparatively short time the proofs had all been provided and the road pipe was being delivered on substantial schedules. The result has been as stated before, a 400-per cent. increase in 1937 over the previous year, and a consistent gain this year.

A company-owned semi-trailer departing with a load of pipe.

The personal contact with contractors has been found sufficient to keep the company informed of jobs that are coming up, in order that the management may know where and when to look for business. The rest of the business-getting depended on salesmanship —and the delivery of a product of specified quality. The company is working "behind time" on its orders now, with a further program of plant improvement being outlined for step-by-step completion as the company continues its emergence from the business doldrums.

Delivery of the road pipe to the spot of use is accomplished by a company-owned tractor-trailer unit. At times in recent months it has been necessary to employ an additional unit, and the company is planning to add another of its own within a short time.

NEW LIME-PUTTY PLANT IN NEW ORLEANS

THE new lime-putty plant of Jahncke Service, Inc., is busy at New Orleans, La., supplying ready-mixed mortar for the huge new Charity Hospital now being erected there. It is the largest job to be serviced by this equipment, which went into operation in January of this year. Up to the time the company began supplying mortar to the hospital project, sales had been confined to smaller jobs and were averaging about 200 cu. ft. of putty daily, or an equivalent of about 25 cu. yd. of mortar.

The lime-putty plant is of standard Brooks-Taylor design and was fabricated at the Birmingham, Ala., plant of the Chicago Bridge & Iron Co. Rotary-kiln pebble lime from the Sherwood, Tenn., plant of the Gager Lime Mfg. Co., Chattanooga, Tenn., is employed. The lime is shipped in bulk in box-cars but later on it is expected that covered hopper-bottom cars will be used.

Slaking procedure at this plant involves filling the slaker partially full with water, lime is added, and this alternate process is continued, being governed by the thermal-control chart, until the batch is completely and thoroughly slaked. The temperature is quickly brought to 185 deg. F. and maintained until the slaked lime is ready for placing in the aging tanks.

The name "Jahncke" has been long and favorably known in New Orleans. Organized in 1870 as Fritz Jahncke, Inc., the corporate name was changed in 1902 to Jahncke Service. Fritz Jahncke remained active in the organization until his death in 1912, when Paul F. Jahncke became president and Walter F. Jahncke, vice-president and treasurer. Both are still the active heads of the company.

The main yard, on the New Basin Canal, covers an area of five city blocks. Besides the lime-putty plant, a ready-mixed-concrete plant which has been in operation for ten years, is located there, as well as warehouses for lumber, various building materials and storage for sand, gravel and shells, which are handled by crane from barges which tie up in the canal. A second yard for storing aggregates is located on Carrollton Ave. and the canal.

Sand and gravel are supplied from seven plants in Louisiana and Mississippi operated by the company and its subsidiaries, the Flint Sand & Gravel Co. and the Brookhaven Gravel Co.

PRACTICAL CONCRETE-MIXTURE DESIGN

By STANTON WALKER
Director of Engineering,
National Ready-Mixed Concrete Assn.

WHILE many methods for the design of concrete mixtures have been advanced, most of them having a great deal of merit, none of them are sufficiently accurate to arrive at "guaranteed" strengths unless supplemented by laboratory tests. They are of principal usefulness, and this is an important function, in arriving at the most economical proportions, *i. e.*, those which will give the highest strength for a given cement content.

The chief difficulty in designing for a specific strength, without the aid of laboratory strength tests, comes from the wide range in the strength-producing properties of different cements. Further, of course, no design for strength should ever be made which contemplates "guaranteeing" the strength of field-cured specimens. All such designs should be based on laboratory curing. Because of differences in temperature and curing conditions in the field, there is no necessary direct relation (particularly at early ages) between the strength of concrete in the job and that cured under laboratory conditions. However, strength tests of specimens cured under standard conditions (moist and at a temperature of 65 deg. to 75 deg. F.) do provide an accurate criterion of the potential strength of job concrete.

A fault of most design methods which have been advanced is that they are either too technical or too detailed to be attractive to the average practical engineer who does not specialize in the design of concrete mixtures. Nevertheless, such engineers do feel the need, from time to time, for a simple procedure which will furnish an approximate idea of the strength which will be obtained for given proportions, or the proportions required to produce given strengths.

In the following there is described a simple procedure. There is nothing new about it. It is based on well-understood principles and is used by a number of engineers. It does not take into account differences in grading of aggregate, except as to maximum size, but it does fit a wide range of aggregates with astonishing accuracy.

Step 1. Assume, or otherwise arrive at, a water-ratio strength relationship. Table I gives a relatively "conservative" one based on average moderate-strength cement and a "probable" one based on results frequently obtained with modern cements.

Step 2. Assume, or otherwise arrive at, the quantity of mixing water per *cubic yard of concrete* required to produce the desired plasticity with the aggregate in question. For all practical purposes of this fairly "rough-and-ready" method of design, the quantity of mixing water per *cubic yard of concrete* will be the same for different strengths, if the aggregate and the plasticity (slump) are the same.

Table I

Compressive Strength at 28 Days (standard curing) (*lb. per sq. in.*)	Water (*gal. per sack of cement*)	
	Conservative	Probable
2000	8	8½
2500	7½	8
3000	6½	7¼
3500	5¾	6½
4000	5¼	6

"Order-of-magnitude" values for average well-graded sand and gravel aggregates are given in Table II.

Table II

Maximum Size of Gravel (*in.*)	Gallons of Water per Cu. Yd. of Concrete (*assumed same for all strengths*)		
	1- to 2-in. Slump	3- to 4-in. Slump	6- to 7-in. Slump
¾	35	38	42
1	33	36	40
1½	32	35	39
2	30	33	36

Step 3. Determine the number of sacks of cement per cubic yard of concrete. That can be done directly from the data in Tables I and II. Merely divide the number of gallons per cubic yard of concrete by the number of gallons per sack of cement. For example, under these assumptions, and using the "conservative" column for gallons per sack, a 3,000-lb.-per-sq.-in. concrete having a 3-in. to 4-in. slump would be produced with a well-graded 1½-in. top-size aggregate using 35 gal. of water per cu. yd. of concrete (total, of course, including moisture) and $\frac{35}{6\frac{1}{2}} = 5.4$ sacks of cement per cu. yd. of concrete. Similarly, a 2,000-lb.-per-sq.-in. concrete with a 3-in. to 4-in. slump would be produced with the 1½-in. aggregate using, *again* 35 gal. of water per cu. yd. of concrete and $\frac{35}{8} = 4.37$ sacks of cement per cu. yd. of concrete.

Step. 4. Determine the quantities of total aggregates per cubic yard of concrete. There are two simple methods. The first, A, is the easier and the less accurate. The second, B, is not much harder and much more accurate.

A. Assume a weight per cubic yard for your concrete. If you don't know it, consider 4,000 lb. close enough for normal gravel-aggregate concrete. The weight may be a little higher for your coarser gradings and a little lighter for your finer gradings, but that figure is a pretty good average. Now, you know the weights of cement and water; just subtract them from 4,000 lb. and you have your total aggregate. For example, in the first example given in Step 3, we have:

35 gal. of water = 292 lb.
5.4 sacks of cement = 508 lb.

Total = 800 lb.

Sand and gravel = 4,000 − 800 = 3,200 lb.

B. The more accurate method requires a knowledge of, or an assumption for, the specific gravity of your aggregates. Assume, for the purpose of this illustration, that the specific gravity is 2.63, and that is not a bad general value to assume. Then a *solid* cubic foot of your material (visualize one big piece of gravel a cubic foot in volume) weighs 2.63 × 62.5 or 164 lb. A further assumption is that each 94-lb. sack of cement contains ½ cu. ft. of solid cement (0.485 is the more generally used figure).

From the preceding we can calculate the volume of the cement paste—it is the volume of solid cement plus the volume of mixing water—per cubic yard of concrete. That quantity subtracted from 27 cu. ft. gives the number of cubic feet of *solid* aggregate and that number multiplied by 164 gives the pounds of total aggregate.

For example, in the first example given in Step 3 (the same as used in B) we have:

35 gal. of water = 4.66 cu. ft.
5.4 sacks of cement = 2.70 solid cu. ft.

Total = 7.36 cu. ft. of paste

27 − 7.36 = 19.64 cu. ft. of solid aggregate

19.64 × 164 = 3,220 lb. total aggregate

Step 5. Determine the proportion of sand and gravel in the total aggregate. That depends to such a large extent on the grading of the aggregates that it is difficult to give approximations. However, you know fairly well what the proportion should be from past experience and, in any event, it should rep-

resent the least quantity of sand which will produce a smooth workable mix. Some figures to aim at are given in Table III.

Table III

Maximum Size of Gravel (*in.*)	Sand (percentage of weight of total aggregate)	
	Lean Mixes	Rich Mixes
¾	50	40
1	47	37
1½	43	33
2	40	30

Step 6. Having completed all your calculations it will be a good idea to increase all the quantities about 1 or 2 per cent. as a factor of safety.

The simple method outlined above has been represented as approximate. However, it is only as approximate as your assumptions. If you know the water-ratio strength relationship applicable to your materials and to the cement to be used and if you know, from experience, or trial, the gallons of water per *cubic yard of concrete* required to produce the desired workability, accurate results will be arrived at.

Alabama and Illinois Operators Win Awards

The winner of the 1937 "Sentinels of Safety" trophy sponsored by the U. S. Bureau of Mines, in the nonmetallic-mineral mine group was the No. 5 Limestone mine, Bessemer, Ala., operated by the Tennessee Coal, Iron & Railroad Co. and worked 173,096 man-hours during 1937 without a lost-time injury to any of the men. This mine was in operation 240 days.

The trophy for the group covering quarries and open-pit mines was awarded to the Illinois State Penitentiary limestone quarry, Menard, Ill. This quarry worked 772,160 man-hours in 1937 without a lost-time accident. The quarry was in operation 235 days.

Sand-and-Gravel Safety Records Are Improved

The ninth annual safety competition conducted during the calendar year 1937 by the Bureau of Mines, in coöperation with the National Sand & Gravel Assn. was featured by a sharp decline in the accident rate, both in frequency and severity, as contrasted with the contest of 1936. Fifty-one sand-and-gravel plants took part in the 1937 contest and the employees of these plants worked more than 3,000,000 man-hours. This contest, from the standpoint of the number of man-hours worked, was one of the largest conducted during the past nine years.

The trophies awarded to the winners of the contest are awarded for the best safety record among plants working 100,000 man-hours or more and for the best safety record among plants working less than 100,000 man-hours. Certificates of honorable mention are awarded to all plants, other than the trophy winners, that are operated through the year without a lost-time accident. The basis for the award is the plant's accident-severity rate, that is, the number of days of disability resulting from accidents for each 1,000 man-hours of work performed. When two or more plants have accident-free records the award goes to the plant with the largest volume of labor.

In conducting the contest, reports of all lost-time accidents are furnished to the Bureau of Mines by all of the competing companies.

The Wolf River plant, Memphis, Tenn., was awarded the trophy in the group of plants that worked 100,000 man-hours or more. This is a wet-pit deposit, and is operated by the Marquette Cement Mfg. Co. The plant operated 122,014 man-hours without a lost-time accident.

The Dividing Creek, N. J., plant was awarded the trophy in the group of plants that worked less than 100,000 man-hours. This is also a wet-pit deposit and it is operated by the South Jersey Sand Co. The plant was active for 77,600 man-hours during 1937 without a lost-time accident.

Honorable mention included plants operated by the American Aggregates Corp., Stewart Sand & Material Co., Consolidated Rock Products Co., Wyoming Sand & Stone Co., Good Roads Gravel Co., Hahn Bros. Sand & Gravel Co., Western Massachusetts Sand & Gravel Co., Blue River Sand & Gravel Co., Schmidt Bros. Sand & Supply Co., Ray Industries, Inc., and Cleveland Builders' Supply Co.

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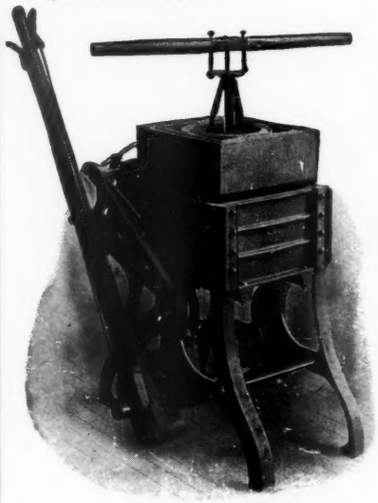

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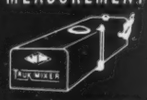

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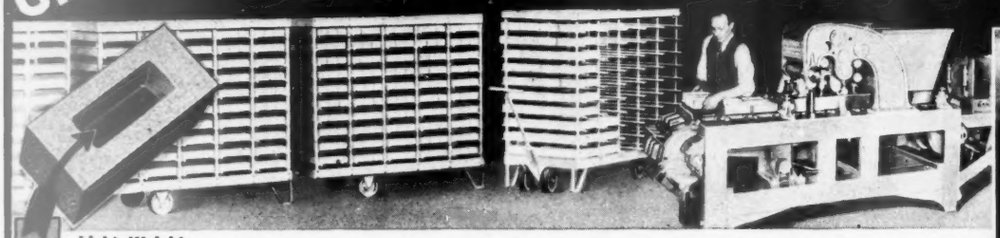

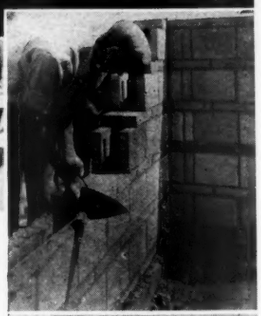

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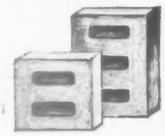

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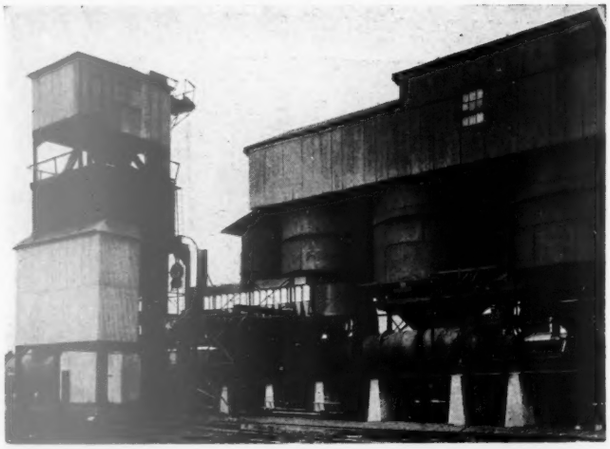

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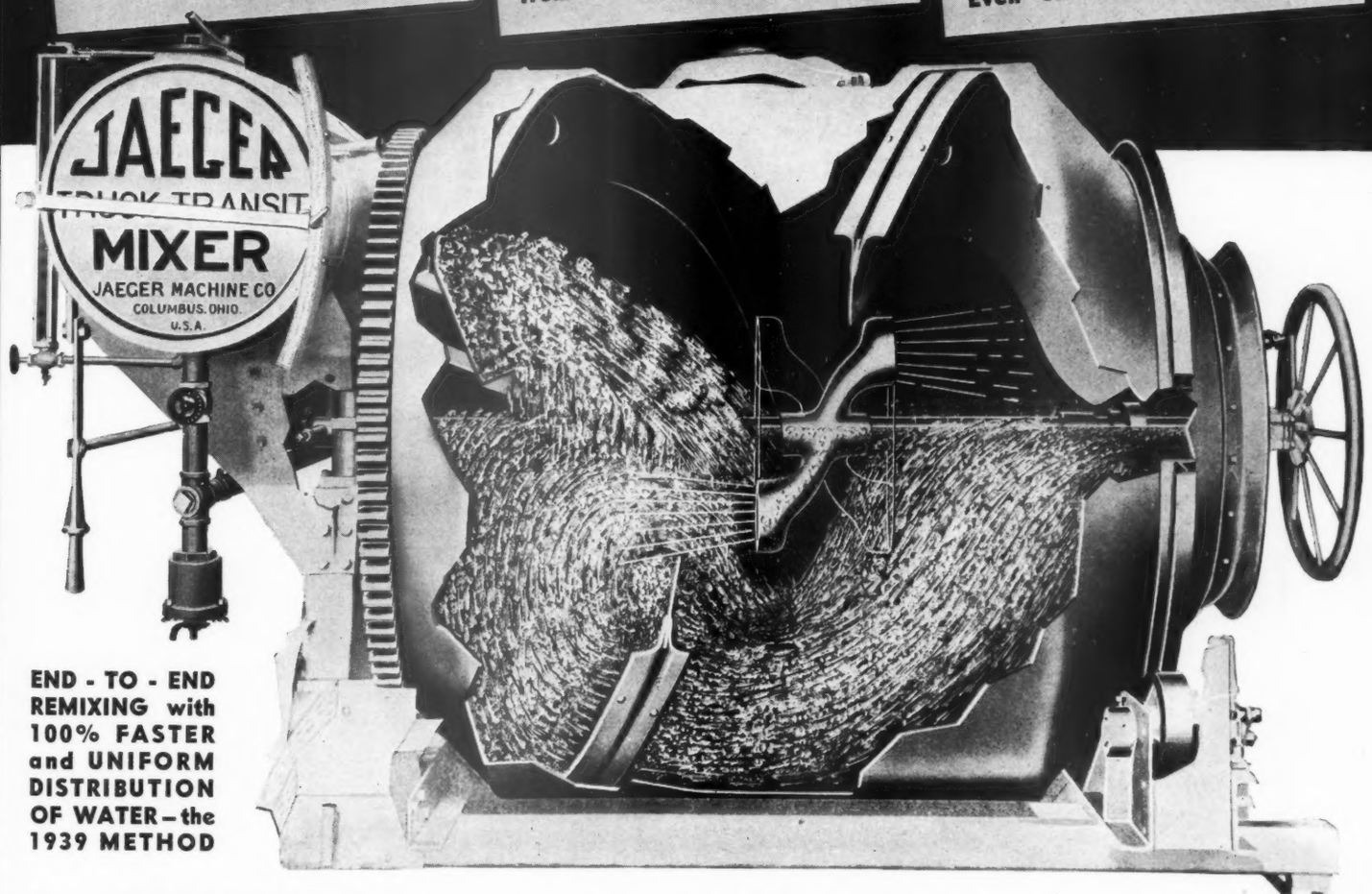

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*Robins Conveying Belt Co.
*Smidth & Co., F. L.
*Sprout, Waldron & Co.

Classifiers
Bradley Pulverizer Co.
*Deister Machine Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Lewistown Foundry & Machine Co.
*Link-Belt Co.
Maddox Foundry & Machine Works
*Norberg Mfg. Co.

Cleaners (Oil)
Precision Engineering Co.

Clips (Wire Rope)
Leschen & Sons Rope Co., A.

Clutches
*Link-Belt Co.
*Sprout, Waldron & Co.

Coal-Pulverizing Equipment
*Allis-Chalmers Mfg. Co.
Bradley Pulverizer Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
*Raymond Pulverizer Div. of Combustion Engr. Co., Inc.
*Smidth & Co., F. L.
Strong-Scott Mfg. Co.
*Traylor Engr. & Mfg. Co.
*Williams Patent Crusher & Pulverizer Co.

Compressors (See Air Compressors)

Concentrators (Slurry)
*Deister Concentrator Co.

Concrete Breakers (Air)
*Chicago Pneumatic Tool Co.

Concrete Mixers
*Blaw-Knox Co.
*Jaeger Machine Co.
*Koehring Co.

Concrete Slab Raising Equipment (Mud Jacks)
*Koehring Co.

Condensers
*Chicago Pneumatic Tool Co.

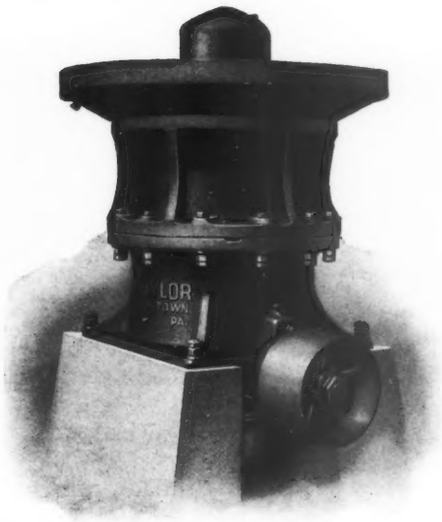
Cones (Sand-Washing)
*Link-Belt Co.
Maddox Foundry & Machine Works
Smith Engr. Works

Conveyor Belting (See Belting)

Conveyor Idlers and Rolls
*Haiss Mfg. Co., Geo.
*Jeffrey Mfg. Co.
*Link-Belt Co.
*Robins Conveying Belt Co.

Conveyors and Elevators
Allen-Sherman-Hoff Co.
*Allis-Chalmers Mfg. Co.
Bacon, Inc., Earle C.
Chicago Steel Fdry. Co.
*Dracco Corp.
*Fuller Company
*Gruendler Crusher & Pulverizer Co.
*Haiss Mfg. Co., Geo.
*Hendrick Mfg. Co.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Co.
Lewistown Foundry & Machine Co.
*Link-Belt Co.
Maddox Foundry & Machine Works
McLanahan & Stone Corp.
New Holland Machine Co.
*Robins Conveying Belt Co.
Smith Engr. Works
*Sprout, Waldron & Co.
Sturtevant Mill Co.

* See also information in the 1938 Pit and Quarry HANDBOOK.



Our Type H Blake Jaw Crusher is a worthy companion of the TY—read all about it in our Bul'etin 1105.

200 satisfied users— plus "repeats"— that's the record of the *TRAYLOR* *TY REDUCTION CRUSHER*

The measure of success of any crusher is how many producers use it profitably,—a few dozen don't mean much, but when hundreds are enthusiastic about it—and say so, voluntarily,—the manufacturer feels that he has accomplished something worth while.

We are much gratified that so many operators are making extra dollars with our "TY", and we know that many others will want to share this advantage when they become acquainted with this wonder worker. Write today, for our Bulletin 2112, and learn about it!

TRAYLOR ENGINEERING & MANUFACTURING CO.

ALLENTOWN, PENNSYLVANIA, U.S.A.

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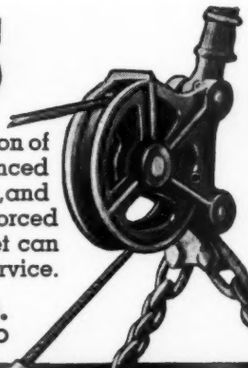
CHICAGO 815 One La Salle St. Bldg.
SALT LAKE CITY 101 West Second South St.
LOS ANGELES 919 Chester Williams Bldg.
SEATTLE 6311 22nd Ave., N. E.
THE CANADIAN FAIRBANKS-MORSE CO., LTD. 980 St. Antoine St., Montreal, P. Q. Canada
B. C. EQUIPMENT CO. Vancouver, B. C. Canada
MAQUINARIA INTERNACIONAL, S. R. I. Av. Francisco I. Madero No. 17 Desp. 214, Mexico, D. F., Mexico
MANILA MACH. & SUPPLY CO. Manila and Baguio, P. I.

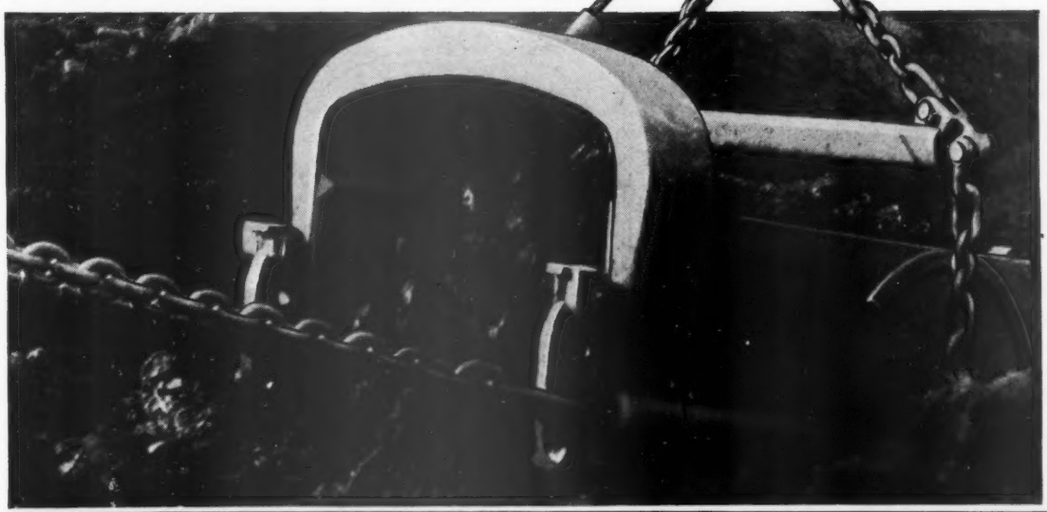
Export Department—104 Pearl St., New York City.
Foreign Sales Agencies: London, Lima, Sao Paulo, Rio de Janeiro, Buenos Aires, Santiago, Valparaiso, Antofagasta, Iquique, Oruro
European Works—Usines Carels Freres, Ghent, Belgium

WILLIAMS *Buckets* built by WELLMAN



It's stronger—lighter—balanced! The elimination of cumbersome excess weight and scientifically balanced design of this bucket allow your operator to work faster, and cover wider areas. Strongly built of alloy steel, reinforced by heavy arch and full length stiffeners, this bucket can be depended upon for many years of profitable service.

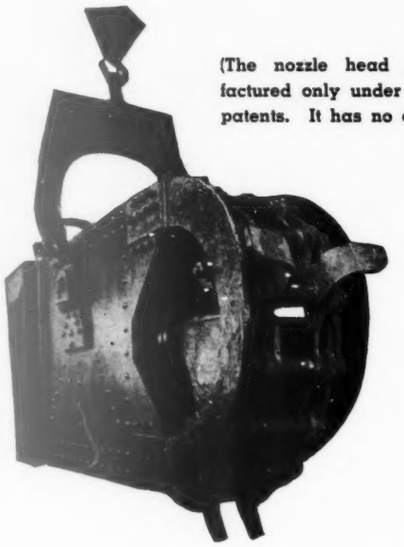
THE WELLMAN ENGINEERING CO.
7014 CENTRAL AVENUE • CLEVELAND, OHIO



Williams Buckets include Power-Arm, Multiple-Rope, and Power-Wheel types.

Tell us the conditions, and we'll send you FREE a special bulletin describing the specific Williams Bucket best fitted to the job.

BUILT TO LAST • • • AND MOVE DIRT FAST



(The nozzle head manufactured only under Eagle patents. It has no equal.)

IN A CLASS BY THEMSELVES FOR LOWERING PRODUCTION COSTS..

EAGLE

"SWINTEK" SCREEN NOZZLE LADDER

They pump more solid material—lower cost of material produced—and show surprising increase in production over plain suction with operating costs often reduced by more than 50%.

The cutters loosen deposit, insure uniform feed of solids, eliminate pumping delays, at the same time carrying oversize up the ladder as the endless chain passes over the nozzle acting as a screen.

Send for descriptive bulletin covering the many outstanding advantages of the Eagle "Swintek". Also ask for particulars for the cleaning of Sand and Gravel.

EAGLE IRON WORKS

DES MOINES, IOWA

BUYERS' GUIDE

A Directory of Pit and Quarry Advertisers Indexed According to Product.

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Conveyors (Pneumatic)
*Dracco Corp.
*Fuller Company

Conveyors (Ready-Mixed Concrete)
*Blaw-Knox Co.
*Haiss Mfg. Co., Geo.
*Jaeger Machine Co.
*Link-Belt Co.
*Robins Conveying Belt Co.

Coolers (Clinker)
*Allis-Chalmers Mfg. Co.
*Smidth & Co., F. L.
*Traylor Engr. & Mfg. Co.

Coolers (See Kilns and Coolers—Rotary)

Correcting Basins
*Smidth & Co., F. L.

Couplings (Flexible and Shaft)
Erie Pump & Engine Works
*Link-Belt Co.
Maddox Foundry & Machine Works
*Robins Conveying Belt Co.
*Sprout, Waldron & Co.

Couplings (Hose)
*Chicago Pneumatic Tool Co.

Cranes (Crawler and Locomotive)
*Bay City Shovels, Inc.
*Bucyrus-Erie Co.
*Koehring Co.
*Link-Belt Co.
*Manitowoc Engineering Works
Thew Shovel Co.

Crusher Hammers
Electric Steel Foundry Co.

Crusher Parts
*American Pulverizer Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Maddox Foundry & Machine Works
McLanahan and Stone Corp.
*Traylor Engr. & Mfg. Co.

Crushers (Cone)
*Nordberg Mfg. Co.

Crushers (Hammer)
*Allis-Chalmers Mfg. Co.
*American Pulverizer Co.
Bradley Pulverizer Co.
*Brooks Equip. & Mfg. Co.
Electric Steel Foundry Co.
*Gruendler Crusher & Pulverizer Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Lime & Hydrate Plants Co.
Sturtevant Mill Co.
*Williams Patent Crusher & Pulverizer Co.

Crushers (Jaw and Gyratory)
*Allis-Chalmers Mfg. Co.
Bacon, Inc., Earle C.
Brooks Equip. & Mfg. Co.
*Gruendler Crusher & Pulverizer Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Lewistown Foundry & Machine Co.
New Holland Machine Co.
*Nordberg Mfg. Co.
Smith Engr. Works
*Traylor Engr. & Mfg. Co.

Crushers (Ring)
*American Pulverizer Co.
*Williams Patent Crusher & Pulverizer Co.

Crushers (Roll)
*Allis-Chalmers Mfg. Co.
*American Pulverizer Co.
*Brooks Equip. & Mfg. Co.
*Gruendler Crusher & Pulverizer Co.
*Jeffrey Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
*Link-Belt Co.
Maddox Foundry & Machine Works
McLanahan and Stone Corp.
New Holland Machine Co.
*Robins Conveying Belt Co.
*Williams Patent Crusher & Pulverizer Co.

Crushers (Rotary)
*Allis-Chalmers Mfg. Co.
*American Pulverizer Co.
New Holland Machine Co.
*Williams Patent Crusher & Pulverizer Co.

Crushing Rolls
*Allis-Chalmers Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
*Link-Belt Co.
Maddox Foundry & Machine Works
McLanahan and Stone Corp.
New Holland Machine Co.
Sturtevant Mill Co.
*Traylor Engr. & Mfg. Co.
*Williams Patent Crusher & Pulverizer Co.

Cutter Heads (Dredging)
*Eagle Iron Works
Maddox Foundry & Machine Works

Diesel Engines (See Engines—Diesel)

Dippers and Teeth (Power Shovel)
*Bucyrus-Erie Co.
*Koehring Co.

Dragline Cableway Excavators
*Bucyrus-Erie Co.
*Link-Belt Co.
*Sauerman Bros., Inc.

Dragline Excavators
*Bay City Shovels, Inc.
*Bucyrus-Erie Co.
*Koehring Co.
*Link-Belt Co.
*Manitowoc Engineering Works
Thew Shovel Co.

Draglines (Walking)
*Bucyrus-Monighan Co.

Dredges
*Bucyrus-Erie Co.
Hetherington & Berner, Inc.
Maddox Foundry & Machine Works
*Morris Machine Works

Drill Bit Reconditioning
*Bucyrus-Erie Co.

Drill Bits
*Chicago Pneumatic Tool Co.

Drill Steel
*Chicago Pneumatic Tool Co.
Cleveland Rock Drill Co.

Drilling Accessories
*Bucyrus-Erie Co.
*Chicago Pneumatic Tool Co.
Cleveland Rock Drill Co.
Timken Roller Bearing Co.

Drilling Contractors
Hoffman Bros. Drilling Co.
Pennsylvania Drilling Co.

Drills (Blast-Hole)
*Bucyrus-Erie Co.
*Chicago Pneumatic Tool Co.
Cleveland Rock Drill Co.

Drills (Core)
Hoffman Bros. Drilling Co.
Pennsylvania Drilling Co.

* See also information in the 1938 Pit and Quarry HANDBOOK.

Drills (Diamond)
*Chicago Pneumatic Tool Co.
Hoffman Bros. Drilling Co.
Pennsylvania Drilling Co.

Drills (Hand Hammer)
*Chicago Pneumatic Tool Co.
Cleveland Rock Drill Co.

Drills (Rock)
*Chicago Pneumatic Tool Co.
Cleveland Rock Drill Co.

Drills (Water Well)
*Bucyrus-Erie Co.

Drills (Well) (See Drills—Blast-Hole)

Drives (Multiple, Belt, Chain, Rope)
*Allis-Chalmers Mfg. Co.

Dryers
*Allis-Chalmers Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Lewistown Fdry. & Mch. Co.
Lime & Hydrate Plants Co.
Maddox Foundry & Machine Works
McLanahan and Stone Corp.
*Traylor Engr. & Mfg. Co.
*Tyler Co., W. S.

Dust Arresters
*Blaw-Knox Co.
*Dracco Corp.
*Parsons Engineering Corp.
*Western Precipitation Corp.

Dust Collecting Systems
Allen-Sherman-Hoff Co.
*Allis-Chalmers Mfg. Co.
*Blaw-Knox Co.
*Dracco Corp.
*Parsons Engineering Corp.
*Raymond Pulverizer Div. of Combustion Engr. Co., Inc.
*Western Precipitation Corp.

Dust Conveying Systems
Allen-Sherman-Hoff Co.
*Blaw-Knox Co.
*Dracco Corp.
*Fuller Company
*Parsons Engineering Corp.
*Western Precipitation Corp.

Dust Filters
Parsons Engineering Corp.
*Western Precipitation Corp.

Dust Handling Systems (Hydro Vacuum)
Allen-Sherman-Hoff Co.

Dust Masks
Chicago Eye Shield Co.

Dynamite (See Explosives)

Electrical Equipment
*Allis-Chalmers Mfg. Co.

Electrodes (Welding)
Stulz-Sickles Co.

Elevator Belting (See Belting)

Elevator Buckets (See Buckets—Elevator and Conveyor)

Elevators (See Conveyors and Elevators)

Eliminators (Soft Stone) (See Soft Stone Eliminators)

Engineers
*Allis-Chalmers Mfg. Co.
Bacon, Inc., Earle C.
Bradley Pulverizer Co.
*Fuller Company
Hetherington & Berner, Inc.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Lime & Hydrate Plants Co.
McLanahan and Stone Corp.
*Robins Conveying Belt Co.
*Smidth & Co., F. L.
*Sprout, Waldron & Co.
Strong-Scott Mfg. Co.
Sturtevant Mill Co.
*Traylor Engr. & Mfg. Co.
Wellman Engineering Co.

Engine Generator Sets
See Generator Sets (Engine).

Engines (Diesel)
Caterpillar Tractor Co.
*Chicago Pneumatic Tool Co.
*Nordberg Mfg. Co.

Engines (Internal-Combustion)
Caterpillar Tractor Co.
*Chicago Pneumatic Tool Co.
*Nordberg Mfg. Co.

Engines (Steam)
Maddox Foundry & Machine Works
*Morris Machine Works
*Nordberg Mfg. Co.

Excavating Machinery (See Shovels; Cranes; Buckets, etc.)

Excavators—Shallow Grading (Bucket Elevator Type)
*Haiss Mfg. Co., Geo.

Fabricating (Electric Arc and Oxy-Acetylene)
Stulz-Sickles Co.

Fans (Exhaust)
*Kennedy-Van Saun Mfg. and Eng. Corp.

Feeders
*Allis-Chalmers Mfg. Co.
Bradley Pulverizer Co.
*Fuller Company
*Kennedy-Van Saun Mfg. and Eng. Corp.
*Link-Belt Co.
Maddox Foundry & Machine Works
*Robins Conveying Belt Co.
Smith Engr. Works
*Sprout, Waldron & Co.
*Traylor Engr. & Mfg. Co.

Filters (Oil)
Precision Engineering Co.

Floor Sweeping Systems (Hydro Vacuum)
Allen-Sherman-Hoff Co.

Fuses (Detonating)
*Ensign-Bickford Co.

Gas Producers
Wellman Engineering Co.

Gaskets
*Cincinnati Rubber Mfg. Co.
Goodyear Tire & Rubber Co.

Gasoline Engines (See Engines—Internal-Combustion)

Gates (Bin) (See Bin Gates)

Gates (Clamshell)
*Haiss Mfg. Co., Geo.
*Link-Belt Co.

Gears (Herringbone)
*Link-Belt Co.
Maddox Foundry & Machine Works
*Sprout, Waldron & Co.

Gears and Pinions
*Haiss Mfg. Co., Geo.
*Jeffrey Mfg. Co.
*Link-Belt Co.
Maddox Foundry & Machine Works
*Sprout, Waldron & Co.

Gelatin (See Explosives)

Generators (See Motors and Generators)

Glass Sand Equipment
Lewistown Foundry & Machine Co.

Goggle Parts
Chicago Eye Shield Co.

Goggles
Chicago Eye Shield Co.

Grab Buckets (See Buckets—Clamshell, Orange - Peel, etc.)

Grapples
Owen Bucket Co.

Grates (Boiler)
Maddox Foundry & Machine Works

Grating (Steel)
*Blaw-Knox Co.
*Hendrick Mfg. Co.

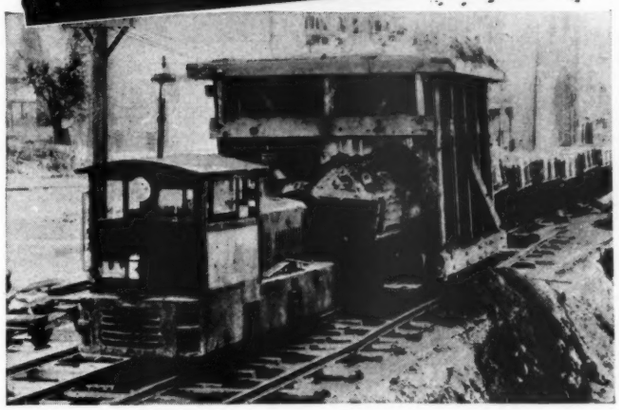
Grinding Balls (See Balls, Grinding)

Grizzly Feeders
*Traylor Engr. & Mfg. Co.

Grizzlies
*Allis-Chalmers Mfg. Co.
*Eagle Iron Works
*Hendrick Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.

* See also information in the 1938 Pit and Quarry HANDBOOK.

COOLIE LABOR
IS CHEAP TO HIRE BUT
EXPENSIVE
TO USE!



● In the Orient, where labor is hired for a pittance, you find Whitcomb Locomotives speeding up the work and stepping up profits. Centuries ago, the invention of the wheel lifted the burden of haulage from men's backs, but the world's greatest progress began when locomotive haulage on steel rails was introduced.

For sixty years, Whitcomb Industrial Locomotives have been solving difficult haulage problems—both under and above the ground. One man hauls many loads at one time with a Whitcomb. The smooth roadway of steel rails, easily shifted, provides a firm footing at all times. The combined resources and experience of Whitcomb and Baldwin assure you the finest in locomotive construction.

Let our engineers survey your haulage requirements and estimate the savings you can expect from Whitcomb equipment. There will be no obligation.

A Type Power to Suit Your Needs

Gasoline or Diesel Mechanical Drive
Gasoline or Diesel Electric Drive
Electric Storage Battery
Electric Trolley

THE WHITCOMB LOCOMOTIVE COMPANY

Plant at Rochelle, Illinois

Subsidiary of The Baldwin Locomotive Works. All sales made by The Baldwin Locomotive Works, Paschall Station Post Office, Philadelphia, Pennsylvania.

WHITCOMB LOCOMOTIVES

BUYERS' GUIDE

A Directory of Pit and Quarry Advertisers Indexed According to Product.

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Lewistown Fdry. & Mach. Co.
Maddox Foundry & Machine Works
Manganese Steel Forge Co.
*Robins Conveying Belt Co.
Smith Engr. Works

Guards (Wire)
Manganese Steel Forge Co.
National Wire Cloth Co.

Guns (Hydraulic)
Hetherington & Berner, Inc.
Taylor Forge & Pipe Works

Hammer Mills (See Crushers—Hammer)

Helmets
Chicago Eye Shield Co.

Hitchings (Links, Pins and Clevises)
Sanford-Day Iron Works

Hoists
*Chicago Pneumatic Tool Co.
Hetherington & Berner, Inc.
*Jaeger Machine Co.
*Link-Belt Co.
Maddox Foundry & Machine Works
McLanahan and Stone Corp.
*Sauerman Bros., Inc.
Smith Engr. Works
*Sprout, Waldron & Co.

Hoppers
*Hendrick Mfg. Co.
*Link-Belt Co.
Maddox Foundry & Machine Works
Manganese Steel Forge Co.

Hose (Air, Steam and Water)
*Chicago Pneumatic Tool Co.
*Cincinnati Rubber Mfg. Co.
Gates Rubber Co.
Goodyear Tire & Rubber Co.

Hose (Petroleum)
Gates Rubber Co.

Hose (Radiator-Engine Cooling)
Gates Rubber Co.
Goodyear Tire & Rubber Co.

Hose Couplings (See Couplings)

Hulls (Steel)
Maddox Foundry & Machine Works

Hydrators
Lime & Hydrate Plants Co.

Hydrate Plants (Complete)
Lime & Hydrate Plants Co.

Hydraulic Guns (See Guns—Hydraulic)

Idlers
*Barber-Greene Co.
*Link-Belt Co.
*Robins Conveying Belt Co.
Smith Engr. Works
*Sprout, Waldron & Co.

Indicators (Material Level)
*Fuller Company

Industrial Safety Equipment
Chicago Eye Shield Co.

Jigs
Maddox Foundry & Machine Works

Joist and Slab Machines (Concrete)
R & L Concrete Machinery Co.

Kilns and Coolers (Rotary)
*Allis-Chalmers Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Lime & Hydrate Plants Co.
*Smidth & Co., F. L.
*Traylor Engr. & Mfg. Co.

Kilns (Vertical)
Lime & Hydrate Plants Co.

Kominuters
*Smidth & Co., F. L.

Ladders (Agitating Dredge)
*Eagle Iron Works
Maddox Foundry & Machine Works

Ladders (Hydraulic Dredge)
*Eagle Iron Works
Maddox Foundry & Machine Works

Lenses (Goggle)
Chicago Eye Shield Co.

Lime-Handling Equipment
*Fuller Company
*Link-Belt Co.
*Raymond Pulverizer Div. of Combustion Engr. Co., Inc.
*Robins Conveying Belt Co.

Lime-Handling Equipment
Lime & Hydrate Plants Co.
*Traylor Engr. & Mfg. Co.

Lime Kilns
*Kennedy-Van Saun Mfg. and Eng. Corp.
Lime & Hydrate Plants Co.

Lime Plants (Complete)
Lime & Hydrate Plants Co.

Linings (Ball- and Tube-Mill) (See Mill Liners and Linings)

Loaders and Unloaders
*Bucyrus-Erie Co.
*Fuller Company
*Haiss Mfg. Co., Geo.
*Link-Belt Co.
*Robins Conveying Belt Co.
*Sprout, Waldron & Co.

Locomotives (Diesel)
*Whitcomb Locomotive Co.

Locomotives (Diesel-Electric)
*Whitcomb Locomotive Co.

Locomotives (Gas-Electric)
*Whitcomb Locomotive Co.

Locomotives (Oil-Electric)
*Whitcomb Locomotive Co.

Magnetic Pulleys (See Pulleys, Magnetic)

Manganese Steel
Manganese Steel Forge Co.

Manganese Steel (Plates and Sheets)
Manganese Steel Forge Co.

Masks
Chicago Eye Shield Co.

Mechanical Rubber Goods
*Cincinnati Rubber Mfg. Co.
Gates Rubber Co.
Goodyear Tire & Rubber Co.

Mill Liners and Linings
*Kennedy-Van Saun Mfg. and Eng. Corp.
Maddox Foundry & Machine Works
*Smidth & Co., F. L.
*Traylor Engr. & Mfg. Co.

Mills (Ball, Tube, etc.)
*Allis-Chalmers Mfg. Co.
*Traylor Engr. & Mfg. Co.

Mills (Grinding) (See also Crushers—Hammer)
*Allis-Chalmers Mfg. Co.
*American Pulverizer Co.
Bradley Pulverizer Co.
*Brooks Equip. & Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Lewistown Fdry. & Mach. Co.
*Raymond Pulverizer Div. of Combustion Engr. Co., Inc.
*Smidth & Co., F. L.
*Sprout, Waldron & Co.
Strong-Scott Mfg. Co.
*Traylor Engr. & Mfg. Co.
*Williams Patent Crusher & Pulverizer Co.

Mixers
Multiplex Concrete Machinery Co.

Motors and Generators
*Allis-Chalmers Mfg. Co.

Motors (Internal-Combustion) (See Engines — Internal-Combustion)

Moulds and Forms (Concrete)
Dunn Mfg. Co., W. E.
Multiplex Concrete Machinery Co.
R & L Concrete Machinery Co.

Netting (Locomotive Stack)
*Tyler Co., W. S.

Nozzles (Gravel Washing)
*Deister Concentrator Co.

Nozzles (Hydraulic) (See Guns—Hydraulic)

Nozzles (Spray)
*Deister Concentrator Co.

Oil Refiners
Precision Engineering Co.

Packings
*Cincinnati Rubber Mfg. Co.
Goodyear Tire & Rubber Co.

"Paintgrip"
American Rolling Mill Co.

Pallets
Multiplex Concrete Machinery Co.

Partitions (Wire)
National Wire Cloth Co

Paving Mixers
*Jaeger Machine Co.
*Koehring Co.

Perforated Metal Plates
*Allis-Chalmers Mfg. Co.
Chicago Perforating Co.
*Hendrick Mfg. Co.
*Sprout, Waldron & Co.

Pipe, Dredge (Floating and Shore)
American Rolling Mill Co.
Naylor Pipe Co.
Taylor Forge & Pipe Works

Pipe Flanges
American Rolling Mill Co.
Hetherington & Berner, Inc.
Naylor Pipe Co.
Taylor Forge & Pipe Works

Pipe Fittings
American Rolling Mill Co.
Hetherington & Berner, Inc.

Pipe Forms (Concrete)
Quinn Wire & Iron Works
R & L Concrete Machinery Co.

Pipe Machines (Concrete)
Quinn Wire & Iron Works
R & L Concrete Machinery Co.

Pipe (Spiral)
American Rolling Mill Co.
Naylor Pipe Co.
Taylor Forge & Pipe Co.

Pipe (Water, Gas, Low Pressure Steam)
American Rolling Mill Co.
Hetherington & Berner, Inc.

Pipe (Welded)
American Rolling Mill Co.
Naylor Pipe Co.
Taylor Forge & Pipe Co.

Plants (Aggremeter) (See Aggremeter Plants)

Plug Valves (See Valves)

Pneumatic Conveying Systems (See Conveyors—Pneumatic)

Pneumatic Drills (See Drills, Rock)

Portable Conveyors
*Barber-Greene Co.
*Fuller Company
Haiss Mfg. Co., Geo.
*Link-Belt Co.
*Robins Conveying Belt Co.

Portable Crushing and Screening Plants
Brooks Equip. & Mfg. Co.
*Gruendler Crusher & Pulverizer Co.
Maddox Foundry & Machine Works
*Williams Patent Crusher & Pulverizer Co.

Portable Engines (See Engines —Internal Combustion)

Portable Loaders (See Loaders and Unloaders)

Powder, (Black, Blasting) (See Explosives)

Power Shovels (See Shovels, Electric, Internal-Combustian and Steam)

Power Tampers (Concrete)
Multiplex Concrete Machinery Co.

Power Units (Internal-Combustion)
Caterpillar Tractor Co.
*Chicago Pneumatic Tool Co.
*Nordberg Mfg. Co.

Precipitators
*Western Precipitation Corp.

Pre-formed Wire Rope
Broderick & Bascom Rope Co.
*Hazard Wire Rope Division of the American Chain & Cable Co., Inc.
*Leschen & Sons Rope Co., A.

Press Machines (Hand, Concrete)
Multiplex Concrete Machinery Co.

Presses (Hydraulic)
Maddox Foundry & Machine Works

Proportioning Equipment
*Blaw-Knox Co.
*Jaeger Machine Co.
Maddox Foundry & Machine Works

Pulleys
Sprout, Waldron & Co.

Pulleys (Magnetic)
*Sprout, Waldron & Co.

Pulleys (Wing)
*Sprout, Waldron & Co.

Pulverized Fuel Systems
*Kennedy-Van Saun Mfg. and Eng. Corp.
*Raymond Pulverizer Div. of Combustion Engr. Co., Inc.

Pulverizers (See also Crushers, Mills, etc.)
*American Pulverizer Co.
Bradley Pulverizer Co.
*Brooks Equip. & Mfg. Co.
*Gruendler Crusher & Pulverizer Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Lewistown Foundry & Machine Co.
New Holland Machine Co.
*Raymond Pulverizer Div. of Combustion Engr. Co., Inc.
*Smidth & Co., F. L.
Strong-Scott Mfg. Co.
Sturtevant Mill Co.
Traylor Engr. & Mfg. Co.
*Williams Patent Crusher & Pulverizer Co.

Pump Valves (See Valves Pump)

Pumps (Air-Lift)
*Chicago Pneumatic Tool Co.
*Fuller Company

Pumps (Bulk Cement)
*Fuller Company

Pumps (Cement Slurry)
Allen-Sherman-Hoff Co.
*Morris Machine Works
*Smidth & Co., F. L.

*See also information in the 1938 Pit and Quarry HANDBOOK.

Clinker Bucket Costs Can Be Reduced....

FOR handling hot clinker to stock pile where no coolers are used, Pyrasteel bucket conveyors will last much longer and will cut the cost per service hour.

Pyrasteel buckets may be made in one piece. They will withstand abrasion and temperatures up to 2200°. They will not warp, oxidize or crack.

For handling cold clinker, these buckets are supplied in Evansteel, the alloy for hard service.

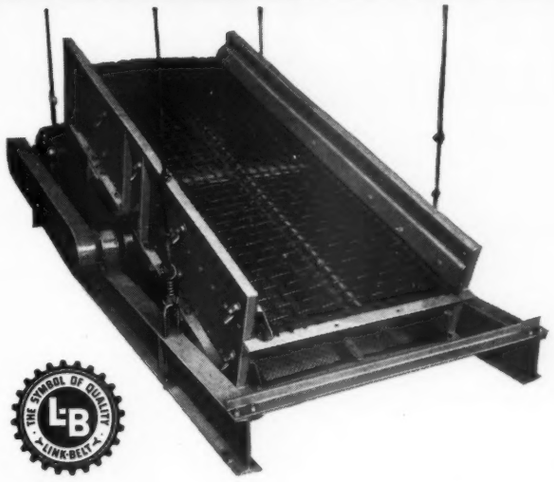
Pyrasteel and Evansteel will cut clinker bucket costs.

CHICAGO STEEL FOUNDRY CO.
Makers of Alloy Steel for Over Twenty Years
Kedzie Ave. at 37th St. Chicago, Illinois

PYRASTEEL for high temperatures

EVANSTEEL for strength

LINK-BELT *Vibrating* SCREENS



● Made in two distinct types, for handling sand, gravel, crushed stone, coal, coke, clay, lime, fertilizer, ores, grain, sugar, chemicals, pulpwood chips, etc. Send for Catalog No. 1562. Address Link-Belt Company, Philadelphia, Chicago, Indianapolis, Atlanta, San Francisco, or any of our offices, located in principal cities.

72828

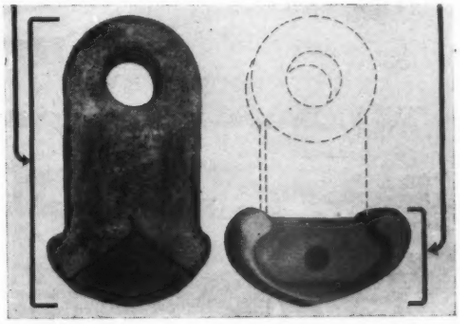
KUNTZ SYSTEM

The Kuntz System of Lime Manufacture includes designing, engineering and the specification, building and erecting of the equipment. Kuntz hydrate plants (either batch or continuous), kilns (automatic shaft or semi-automatic shaft), are marvels of efficiency, producing quality lime under complete control at the lowest possible cost. Minimum maintenance and maximum flexibility are other noteworthy features.

LIME & HYDRATE PLANTS CO.
Box 574
York, Pa.

DO YOU THROW AWAY

THIS - - - or - - - THIS



55 lbs. - - - or - - - 15 lbs.

when you replace your hammers

Let us tell you the savings effected by using

ESCO RENEWABLE HEAD HAMMERS

These hammers have been used by several leading cement mills for several years with complete success. Write today.

Patented

ELECTRIC STEEL FOUNDRY CO.
Western Manufacturers
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Seattle, San Francisco, Los Angeles, Denver

KENSINGTON STEEL COMPANY
Eastern Manufacturers
505 Kensington Ave., CHICAGO

BUYERS' GUIDE

A Directory of Pit and Quarry Advertisers Indexed According to Product.

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*Allis-Chalmers Mfg. Co.
Erie Pump & Engine Works
Hetherington & Berner, Inc.
*Jaeger Machine Co.
Kansas City Hay Press Co.
Maddox Foundry & Machine Works
*Morris Machine Works

Pumps (Dewatering)
*Allis-Chalmers Mfg. Co.
Erie Pump & Engine Works
*Morris Machine Works

Pumps (Dredging)
Allen-Sherman-Hoff Co.
*Allis-Chalmers Mfg. Co.
Bucyrus-Erie Co.
Erie Pump & Engine Works
Hetherington & Berner, Inc.
Kansas City Hay Press Co.
Maddox Foundry & Machine Works
*Morris Machine Works

Pumps (Sand and Gravel)
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*Allis-Chalmers Mfg. Co.
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Kansas City Hay Press Co.
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*Morris Machine Works

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*Chicago Pneumatic Tool Co.

Pumps (Turbine)
*Allis-Chalmers Mfg. Co.
Erie Pump & Engine Works
*Morris Machine Works

Pumps (Vacuum)
*Chicago Pneumatic Tool Co.
*Fuller Company

Pumps (Vertical)
*Allis-Chalmers Mfg. Co.
Erie Pump & Engine Works
*Morris Machine Works

Pumps (Well)
*Allis-Chalmers Mfg. Co.
Erie Pump & Engine Works
*Morris Machine Works

Racks (Curing)
Multiplex Concrete Machinery Co.

Ready-Mixed Concrete Plants
*Jaeger Machine Co.

Respirator Parts
Chicago Eye Shield Co.

Respirators
Chicago Eye Shield Co.

Rock Drills (See Drills—Rock)

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*Kennedy-Van Saun Mfg. and Eng. Corp.
*Traylor Engr. & Mfg. Co.

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Stulz-Sickles Co.

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Chicago Eye Shield Co.

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*Link-Belt Co.

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Smith Engr. Works

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*Merrick Scale Mfg. Co.

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*Allis-Chalmers Mfg. Co.
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Chicago Perforating Co.
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*Deister Concentrator Co.
*Deister Machine Co.
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*Gruendler Crusher & Pulverizer Co.
*Haiss Mfg. Co., Geo.
Harristeel Products Co.
*Hendrick Mfg. Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
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*Link-Belt Co.
Ludlow-Saylor Wire Co.
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*Nordberg Mfg. Co.
*Robins Conveying Belt Co.
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*Sprout, Waldron & Co.
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*Tyler Co., W. S.

Screens (Vibrating or Shaking)
*Allis-Chalmers Mfg. Co.
*Deister Concentrator Co.
*Deister Machine Co.
*Gruendler Crusher & Pulverizer Co.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Lewistown Foundry & Machine Co.
*Link-Belt Co.
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New Holland Machine Co.
*Nordberg Mfg. Co.
*Robins Conveying Belt Co.
Screen Equipment Co.
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*Sprout, Waldron & Co.
Sturtevant Mill Co.
*Tyler Co., W. S.
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*Traylor Engr. & Mfg. Co.
*Tyler Co., W. S.

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*Sprout, Waldron & Co.

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American Rolling Mill Co.

Shovels (Electric, Internal-Combustion and Steam)
*Bay City Shovels, Inc.
*Bucyrus-Erie Co.
*Koehring Co.
*Link-Belt Co.
*Manitowoc Engineering Works
Thew Shovel Co.

Silos
*Smidth & Co., F. L.

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*Allis-Chalmers Mfg. Co.
Hetherington & Berner, Inc.
*Jeffrey Mfg. Co.
*Link-Belt Co.
*Robins Conveying Belt Co.

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*Cincinnati Rubber Mfg. Co..

Speed Reduction Units
*Link-Belt Co.

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Sprays
*Deister Concentrator Co.

Sprockets and Chain
*Link-Belt Co.
*Sprout, Waldron & Co.

Stacks (Smoke)
Maddox Foundry & Machine Works

Steel (Alloy)
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Manganese Steel Forge Co.

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Manganese Steel Forge Co.

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*Sprout, Waldron & Co.

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Owen Bucket Co.

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*Haiss Mfg. Co., Geo.
*Link-Belt Co.
*Sauerman Bros., Inc.

Sweeping Systems
Allen-Sherman-Hoff Co.

Tamp Machines (Hand, Concrete)
Multiplex Concrete Machinery Co.

Tanks
Bartlett & Snow Co., C. O.
*Hendrick Mfg. Co.
*Link-Belt Co.
Maddox Foundry & Machine Works
*Traylor Engr. & Mfg. Co.

Tanks (Sand-Settling)
*Link-Belt Co.
Smith Engr. Works

Testing Sieves and Shakers
*Hendrick Mfg. Co.
*Tyler Co., W. S.

Tire Repair Materials
Goodyear Tire & Rubber Co.

Tires (Truck, Passenger Car or Tractor)
Goodyear Tire & Rubber Co.

Tools (Drill) (See Drilling Accessories)

Track Shifters
*Nordberg Mfg. Co.

Tractors
*Allis-Chalmers Mfg. Co.
Caterpillar Tractor Co.

Trailers (Dump)
Sanford-Day Iron Works

Transformers
*Allis-Chalmers Mfg. Co.

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Transmission Machinery
*Allis-Chalmers Mfg. Co.
*Gruendler Crusher & Pulverizer Co.
*Link-Belt Co.

Trippers
*Link-Belt Co.
*Robins Conveying Belt Co.

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*Blaw-Knox Co.
*Jaeger Machine Co.

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Tubes (For Tire Casings)
Goodyear Tire & Rubber Co.

Underground Loaders
*Allis-Chalmers Mfg. Co.

Unloaders (Box Car)
*Barber-Greene Co.
*Fuller Co.
*Link-Belt Co.

Valves (Pump)
*Cincinnati Rubber Mfg. Co.
Taylor Forge & Pipe Works

Variable Speed Reducers or Transmissions
*Link-Belt Co.

Vibrating Screen Plate
Chicago Perforating Co.
*Hendrick Mfg. Co.
*Link-Belt Co.
Manganese Steel Forge Co.

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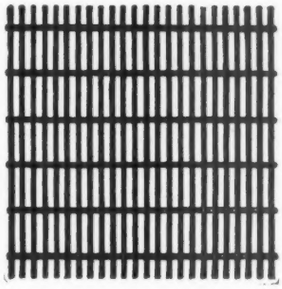
Vibrators
*Tyler Co., W. S.

Wagon Scrapers
Continental Roll & Steel Fdry. Co.

Wagons (Dump)
*Koehring Co.

Washers (Sand, Gravel and Stone)
*Allis-Chalmers Mfg. Co.
*Eagle Iron Works
*Haiss Mfg. Co., Geo.
*Kennedy-Van Saun Mfg. and Eng. Corp.
Lewistown Foundry & Mach. Co.
*Link-Belt Co.
Maddox Foundry & Machine Works
McLanahan and Stone Corp.
*Smidth & Co., F. L.
Smith Engr. Works
*Traylor Engr. & Mfg. Co.
*Tyler Co., W. S.

* See also information in the 1938 Pit and Quarry HANDBOOK.



Rolled Slot

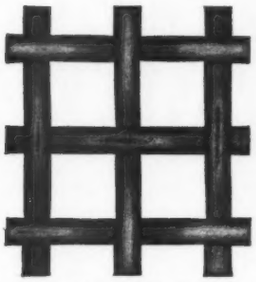
ALLOY No. 2

A super wearing Steel developed to resist the abrasion and vibration of modern screening demands.

"CLEVELAND" SCREENS

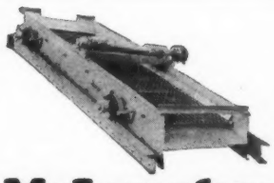
A wire cloth of guaranteed accuracy backed by fine workmanship and an effort to satisfy.

Available in Square Mesh and Rolled Slot. A trial will convince you of the superiority.



2 Mesh .162 Ga.

THE CLEVELAND WIRE CLOTH & MFG. COMPANY
574 E. 78th St. CLEVELAND, OHIO



McLanahan Equipment

Single and double roll and jaw crushers, hammer mills, super dry pans,—steel log washers and scrubbers, sand drags, revolving and vibrating screens, elevators, conveyors, dryers, jigs, hoists,—complete portable, semi-portable and stationary crushing, screening and washing plants for different capacities of any materials.

McLanahan & Stone Corporation
Continuously in Business Since 1835
Hollidaysburg, Pennsylvania

WHICH ARE THE WICKED DUSTS?

Cement? Sand? Stone? Coal? Coke? Lime? Silica? Asbestos? Phosphate? Mica? Fuller's Earth? Lead?

Some are irritants to nose, throat, lungs; others make invalids; lead produces Plumbism. None good! All are excluded by the use of Cesco's New, No. 92

HEALTH GUARD RESPIRATOR

Approved By U. S. Bureau Of Mines For Type "A" and Lead Dusts.

In this modern mask frequent changing of filters, breathing fatigue, the old style exhale valve that caught in the shirt when head was bent down—are all ELIMINATED. Other new features added. Write

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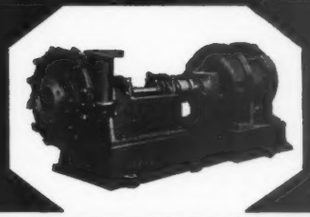
MORRIS
CENTRIFUGAL PUMPS



For handling abrasive materials, corrosive liquids, or clear water. Special designs and materials for each service to provide long life, maintenance of initial high efficiency and low upkeep cost.

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Baldwinsville, N. Y.

MORRIS MACHINE WORKS · BALDWINSVILLE, N.Y.

CYLPEBS

Cast Cylindrical Grinding Bodies

Special Mixture of Hard Iron

For

PULVERIZING MILLS

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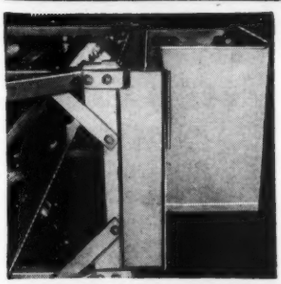
F. L. SMIDTH & CO.
225 Broadway NEW YORK, N. Y.

Advertise your wants and surplus equipment in

WEIGHING while conveying



WITH THE

MERRICK WEIGHTOMETER

Applicable to any size belt conveyor, horizontal or inclined. An accurate and dependable means of keeping constant check on production.

WRITE FOR BULLETIN 375

MERRICK SCALE M'FG. CO.
PASSAIC NEW JERSEY

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*Fuller Co.
*Jaeger Machine Co.
*Merrick Scale Mfg. Co.

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Stulz-Sickles Co.

Welding and Cutting Equipment
Stulz-Sickles Co.

Welding Rods
Bradley Pulverizer Co.
Stulz-Sickles Co.

Welding Service
Stulz-Sickles Co.

Wheels (Car)
Sanford-Day Iron Works

Winches and Capstans
*Jeffrey Mfg. Co.
*Link-Belt Co.
Maddox Fdry. & Machine Works
*Robins Conveying Belt Co.
*Sprout, Waldron & Co.

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Harris Steel Products Co.
Ludlow-Saylor Wire Co.
Manganese Steel Forge Co.
National Wire Cloth Co.
*Robins Conveying Belt Co.
*Roebling's Sons Co., John A.
*Tyler Co., W. S.

Wire Rope
Broderick & Bascom Rope Co.
*Hazard Wire Rope Division of The American Chain & Cable Co., Inc.
Leschen & Sons Rope Co., A.
*Roebling's Sons Co., John A.
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Wire Rope Fittings
Broderick & Bascom Rope Co.
*Hazard Wire Rope Division of The American Chain & Cable Co., Inc.
Leschen & Sons Rope Co., A.
*Roebling's Sons Co., John A.
Union Wire Rope Co.

Wire Rope Slings
Broderick & Bascom Rope Co.
*Hazard Wire Rope Division of The American Chain & Cable Co.
Leschen & Sons Rope Co., A.
*Roebling's Sons Co., John A.
Union Wire Rope Co.

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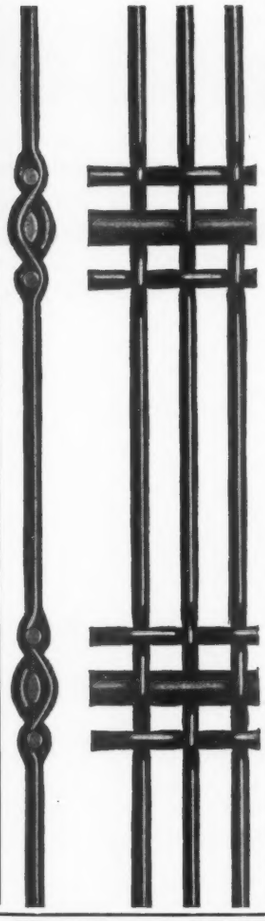
*Roebling's Sons Co., John A.
*Westinghouse Electric & Mfg. Co.

Worm Gears (See Gears and Pinions)

* See also information in the 1938 Pit and Quarry HANDBOOK.



STA-TRU

Long-Mesh Woven Wire Screens

made to work under tension and vibration.

The straight stay - bars carry ALL the tension. The crimps in the round wires can not be stretched or broken. The screen can not be caused to sag or split by the pull of the tensioning device.

LUDLOW-SAYLOR WIRE CO. ST. LOUIS

COMPOUND FUNNEL CLASSIFIER

For sizing minus 5/16" gravel and sand, and for cleaning it by washing out silt and other light impurities.

Descriptive Bulletin No. 23

PLAT-O

Improved Heavy Duty

VIBRATING SCREEN

Built in all standard sizes—in from one to three decks.

Write for Descriptive Bulletin No. 26

DEISTER MACHINE COMPANY

1933 EAST WAYNE STREET FT. WAYNE, IND.

Still Going Up!

The number of executives subscribing to PIT AND QUARRY rises steadily.

Every month occasional readers decide to make the reading of PIT AND QUARRY a regular habit and so the list of paid subscribers grows. Why not make the same decision for yourself today and have the copies addressed to you personally? As an added means of preventing delay in receiving their copies many executives have PIT AND QUARRY sent to their homes, where it can be read at leisure and in comfort.

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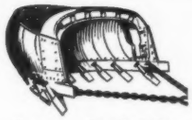
Whatever your company's products may be, whatever your personal responsibility may be, whatever industrial problems may interest you most, PIT AND QUARRY should be your choice for news, for descriptions of new plants, processes and equipment, and for practical discussions of the matters that vitally affect your business.

The price is still $1 for one year.

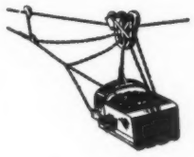
PIT AND QUARRY PUBLICATIONS

538 South Clark Street, Chicago, Ill.

Publishers of *Pit and Quarry Handbook* and *Pit and Quarry Directory*



Scraper bucket for dragging materials over the ground.



Slackline Cableway bucket for hauling materials to a high dumping point.

SAUERMAN
LONG RANGE MACHINES

Problems of moving gravel, sand, crushed rock, etc., distances of 100 to 1500 ft. are solved most cheaply with Sauerman Drag Scraper or Slackline machines.

There is a double saving when you use a Sauerman machine. You keep down your equipment investment and your daily operating expense is lower than with any other equipment able to dig and haul an equal yardage.

SAUERMAN BROS.
434 S. Clinton St. - - - Chicago

PULVERIZERS
Capacities---1 to 50 Tons per hr.
Finenesses---20 to 350 Mesh.

Air Classifiers

Sizes for any desired capacity.
The MODERN **AIR SEPARATOR**
BRADLEY PULVERIZER CO.
ALLENTOWN, PENNA.

Lewistown Foundry Products
ARE
Performance-Tested

BUCKET ELEVATORS
REVOLVING SCREENS
CRUSHERS DRY PANS

Lewistown Foundry & Machine Co.
Lewistown, Pa.

ROUND
SQUARE
SQUAROUND*
HEXAGON
PERFORATED PLATE
of every description
for maximum productiveness from your vibrating screens.
*Reg. U.S. Pat. Off.

HENDRICK MANUFACTURING CO.
39 Dundaff Street, Carbondale, Pa.
Sales Offices in Principal Cities. Please Consult Telephone Directory

AIR COMPRESSORS
ALL TYPES & SIZES

ROCK DRILLS
SINKERS — DRIFTERS
WAGON DRILLS
DIAMOND DRILLS

CHICAGO PNEUMATIC TOOL COMPANY
6 EAST 44th STREET NEW YORK, N. Y.

CONVEYING SYSTEMS FOR PULVERIZED, FINE, CRUSHED & GRANULAR MATERIALS
FULLER-KINYON — FLUXO — AIRVEYOR
ROTARY FEEDERS - DISCHARGE GATES
FULLER ROTARY COMPRESSORS AND VACUUM PUMPS
AUTOMATIC BATCH WEIGHERS
BIN SIGNALS

FULLER COMPANY
CATASAUQUA, PENNSYLVANIA
Chicago: Marquette Bldg. San Francisco: Chancery Bldg.

LIGHTNING
Heavy-Duty (Ball-Bearing)
Sand and Gravel
PUMPS

High efficiency — low operating cost—precision workmanship — wear-resisting, non-heating bearings even when operated under extremely high heads. WRITE

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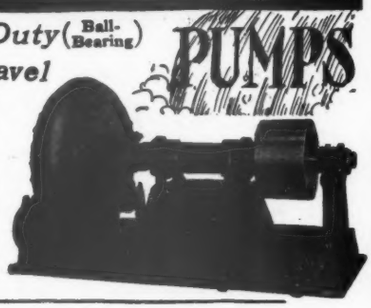

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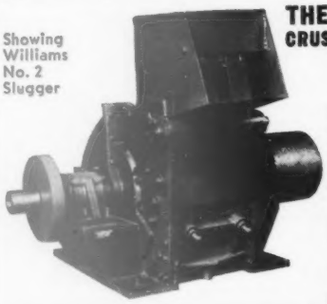
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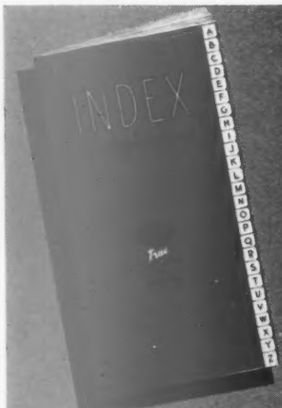

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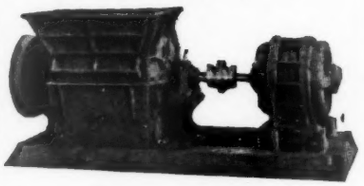

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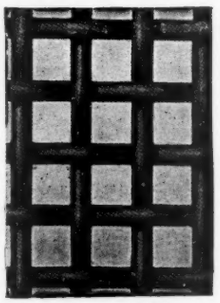

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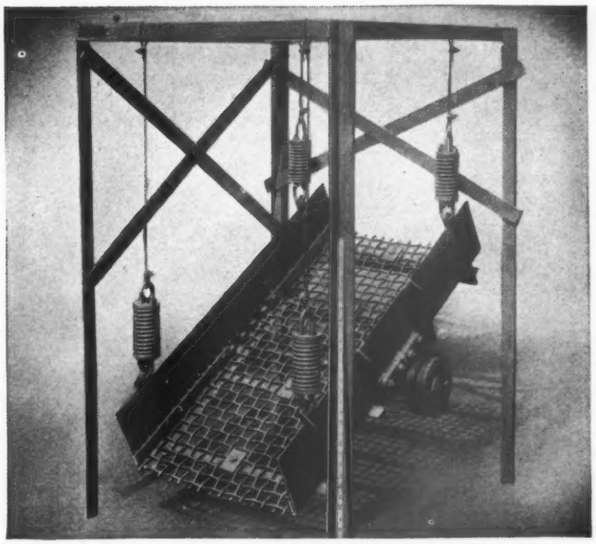

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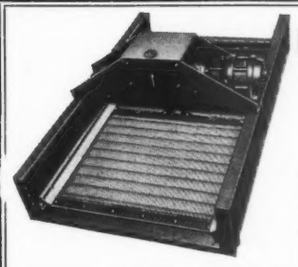

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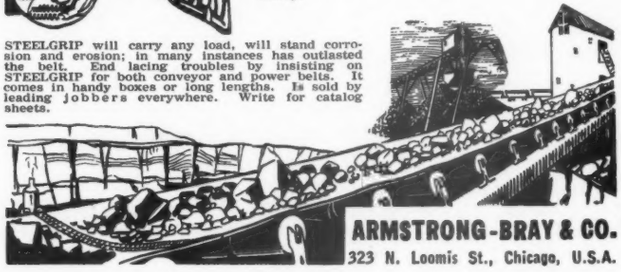

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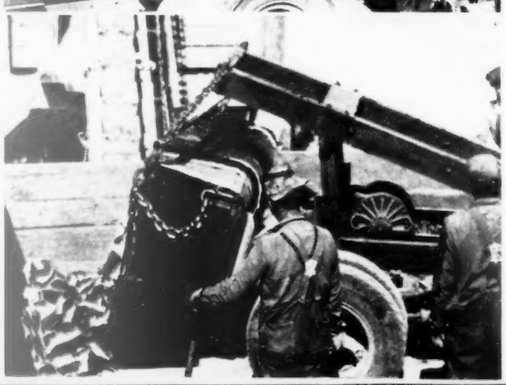

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